FLIGHT
and
The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1702. Vol. XL. AUGUST 7th, 1941. Thursdays, One Shilling.

# The Outlook

## The Great Daylight Raid

THE daylight attacks by the R.A.F. on Brest and La Pallice, where the German warships are berthed, must have given the enemy furiously to think. Daylight raiding was their pet project last summer, and it had to be abandoned in favour of night bombing, which has taken them no whit farther towards winning the war. The daylight bombing, they hoped, would settle their last enemy in a few weeks. Yet, though the Heinkels and Junkers came at the coasts of Britain in their hundreds day after day, they failed to break the resistance of the indomitable R.A.F. Fighter Command.

What the *Luftwaffe* failed to accomplish must surely (in German reasoning) be an impossibility for the Royal Air Force. Yet the R.A.F. set out by day as well as by night to attack the *Scharnhorst* and her consorts, and achieved their object (so it is officially stated) in spite of all the defence preparations of the enemy. Fifteen British bombers were lost, and we mourn for their gallant crews; but what is such a loss in comparison with the hecatombs of German raiders which strewed the fields of England last summer!

This raid was part of the Battle of the Atlantic, and that gives special cause for gratification. There was no long-term policy about it; it was not planned to prevent the Germans from winning battles in 1943. The most critical struggle in progress at the moment is the safeguarding of the life-line between the Americas and Great Britain. If three such vessels as the *Scharnhorst*, *Gneisenau* and *Prinz Eugen* got loose again in the Atlantic and started sinking ships, they might do an infinity of damage. It will be some time, it is confidently hoped, before any one of them is in case to make an attempt to take to the high seas again. Perhaps they will never do so.

That is a concrete gain of which the results should be visible for all to see in coming weeks. When the British citizen enjoys the tinned salmon and other good things which are coming from Canada and the United States, he will have cause to thank the R.A.F., as well as the sailors of the Royal and Merchant Navies. Upsetting the marshalling yard at Hamm may cause inconvenience to the Germans (we hope it does), and attacks on their production may take effect later in the war. But the Battle of the Atlantic is on us now, and in helping the Navy to win that battle the Air Force has done work than which no other of its achievements can be more important.

## Air Ministry Strategy

THIS train of thought brings one back to another question which has been asked before in these columns—is not the Air Ministry too much obsessed with the idea of strategic bombing? It is naturally attractive to the staff of any fighting Service to feel that it can boast a strategy of its own, that it is undertaking independent action and is not merely (as some might say) an ancillary to either the Navy or the Army. Time and again R.A.F. officers have made the statement—and have not some members of the Air Council said the same?—that it is bombing which will bring us victory. By that the speakers obviously meant, not bombing to help the operations of the Navy or Army, but independent action against German production.

So far, one looks in vain for evidence that this strategic

bombing has put any check on the operations of the German Army. There have been pauses in the invasion of Russia while the invaders reformed and refitted, patched up their tanks and brought up more supplies of fuel and ammunition, but these pauses were obviously due to the resistance of the Russian armies and their air contingents. Nothing suggests that they were due to damage done by British bombing operations against factories.

During the months when the German land forces were not fighting at all those factories must have been turning out material far faster than it was being consumed, and certainly the efforts of the R.A.F. did not stop anything like fifty per cent. of the output. The Red Air Fleet, working in close collaboration with the Red Army, has done far more damage to German fighting power. Likewise the R.A.F., by tactical operations which have kept German warships in harbour, has done good service in the critical Battle of the Atlantic.

Bombing of enemy production must certainly go on. It would be folly not to interfere with that production. But it is raising extravagant hopes to suggest that this single operation will bring us victory. Combined operations between the Services are a much more hopeful road, and it would be a distinct gain if that were frankly recognised by the Air Staff. The one great British offensive which has been a complete success so far is the series of Middle East campaigns in Africa and Asia. These will go down in history as classical examples of combined operations. The rôle of the Air Forces was ancillary, but none the less important for that. In fact, tactical bombing has so far proved far more valuable in this war than strategical bombing has done. The experiences of the Germans, the Russians, and our own Middle East campaigns all support that theory.

## Production

WHEN the House of Commons went into committee on supply last week the Prime Minister gave certain encouraging indications of the progress made with war production, of which we are concerned only with those dealing with aircraft.

Of our fighters, Mr. Churchill said that they are at least as much ahead of the enemy as they were when we defeated him a year ago. He did not refer to fighter output, and from that fact one may infer that we have enough actually built and building. Referring to bombers, the Prime Minister said that in the past year British production alone had doubled our power of bomb discharge at 1,500 miles range. In the next three months British and American bomber production would double that figure, and during the following six months it would be redoubled. Truly this is a creditable performance and one of which the aircraft industry may be proud. In this connection it is only fair to point out a fact which is not always remembered.

Gratifying though the Prime Minister's figures are, what the country really wants to know is whether aircraft production can be still further increased. The figure of 75 per cent. of "possible" output has been freely mentioned as our present efficiency. Enthusiasts aim at 100 per cent., forgetting that this is unattainable. Without wishing to join in what Mr. Churchill described as a "dismal cacophonous chorus of stinking fish," we do not feel that no further increase of aircraft output is possible. It is not unreasonable to estimate that another ten per cent. could be attained, not by the establishment of a Minister of Production, but by giving one man authority to transfer output capacity from one supply department to another as need arises.

**SUNDERLAND SERVICE:** To maintain the extreme reliability which is required for the long sea patrols of the Coastal Command, the utmost care must be taken during inter-flight overhauls. The apparently headless Ack Emma on the nearest wing is only a pair of overalls.

# War in the Air

## Sicilian Air Bases Bombed : The Moscow Raids : Stukas at Tobruk

**UNHAPPY LANDING:** The efficiency of the Russian Air Force has been a surprise to many, including, one imagines, the *Luftwaffe*. Here is the wreck of a Ju 88 which fell to the guns of a Red airman.

IN our last issue a raid on London was briefly mentioned. It followed (and one is inclined to argue *post hoc, ergo propter hoc*) a raid by the R.A.F. on Berlin a few nights before. Not many British bombers were sent there, but the raid marked the gradual increase in the hours of darkness as the summer moves along. If the *propter hoc* argument is correct, it shows that the Germans are very sensitive to attacks on their Capital, and try to warn us off by means of retaliation. The R.A.F. will not be deterred from following its own objects by such means. There are many targets in Berlin which are worth destroying, and they will be attacked whenever it suits the book of the Bomber Command to send machines against them.

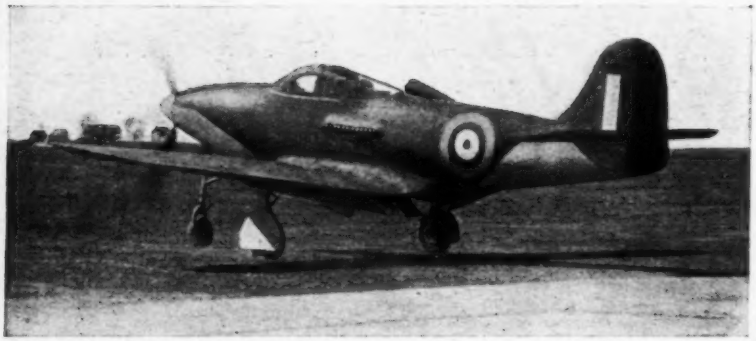
The German raid on London was also not on a very heavy scale, though there seemed to be plenty of engines droning overhead. Four of the raiders were shot down, and this is considered to be a satisfactory proportion. The night-bomber has not yet been defeated, but its operations are growing more hazardous, and the time may come when losses are so heavy that the operation may be abandoned as not worth while, as the Germans have already abandoned day-bombing against Great Britain. The R.A.F., on the other hand, is quite prepared to undertake daylight bombing if the object justifies the losses which must be faced. The recent raids on Brest and La Pallice proved that. The question arises as to which side would lose most if all night-bombing had to be abandoned—but the time for that to come about is not imminent.

### Fine Middle East Work

WHETHER it is good luck or good management, the bombers in the Middle East Command have been suffering very slight casualties in their widespread operations. Not long ago R.A.F. machines made a brilliant attack on the aerodromes in Sicily, Catania, Syracuse (a seaplane base), Marsala, and Borizzo near Trapani. Over thirty-four enemy machines of various types were destroyed, all of them Italian except for one Ju 52 troop-carrier at Catania. That looks as if the Stukas have left that base and moved elsewhere. Not a single R.A.F. machine was lost during this series of raids. It now seems a pity that this raid was not undertaken before the British convoy made its way through the Mediterranean with the loss of the destroyer *Fearless* and damage to a cruiser, another destroyer and one of the merchant ships, but it will now be desirable to discover the new lair of the Stukas and give it a similar hammering.

Up to the moment of writing, the Russians have continued to hold the Germans, and the Red Air Fleet declines to admit any inferiority to the *Luftwaffe*. Its operations emphasise once again the absolute importance of providing an army with adequate support from the air, and that means that troops and aircraft must be trained to work in unison. If the Russian air arm had been wiped out as thoroughly as was that of the Poles in the first campaign of this war, it is inconceivable that the invaders could have been held as they have been. The famous German tactics of carrying all before them by a combination of Panzer divisions and close-co-operation bombers, while other aircraft provided full information about the dispositions of the enemy, have failed for the first time to bring swift success. There is a lesson in this which it is to be hoped that our High Command is studying with care.

One does not know quite what to make of the reports of the German



**CARIBOUS ARE COMING: Here is the first picture of a Bell Caribou with R.A.F. markings, just about to take off, with flaps partially lowered to increase lift. Note the nose wheel and the exhaust stubs of the "midships" Allison.**

raids on Moscow. There have been numerous raids, and, so far as can be judged, none of them has achieved any considerable success. We have learnt by experience what credence to give to German reports of air gains and losses, and so the reports about these raids which issue from Berlin are not regarded as evidence of anything. The Russians, we may assume, are determined not to give out any information which might be of any conceivable use to the enemy. The Tass Agency gave the following report on the raid on the night of July 28: "Between 140 and 150 enemy aircraft tried to effect a mass raid on Moscow. The A.A. barrage and night fighters dispersed the German enemy formations and prevented them from penetrating over Moscow. Only four or five enemy aircraft reached the city." Everybody must wish that the defences of London were able to do as well as that.

The Netherlands East Indies, following the action of the United States and Britain in freezing Japanese credits, have taken similar steps. It was first reported that they had suspended the oil agreement recently concluded with Japan. This proved to be incorrect, but it came as a stunning shock to the Japanese, though what they could have expected after their aggressive action in Indo-China is not obvious. Oil supplies will be limited. The *Japan Times and Advertiser* frankly, and angrily, admitted that Japan must have oil, whether from the United States or the East Indies. Presumably the Japanese have been building up reserves of oil before making their move against the French Protectorate, but to what extent cannot be estimated. The "China Incident" must have been using up a great deal of that precious liquid, and without ample supplies it will not benefit Japan to have secured a strong strategical position in Indo-China from which blows by air and sea might be dealt in various directions. Aircraft and warships are not very effective if deprived of their motive power.

Reverting to the Middle East, it will be remembered that after the British troops left Greece General Sir Thomas Blamey issued an Order of the Day in which he remarked on the

## WAR IN THE AIR

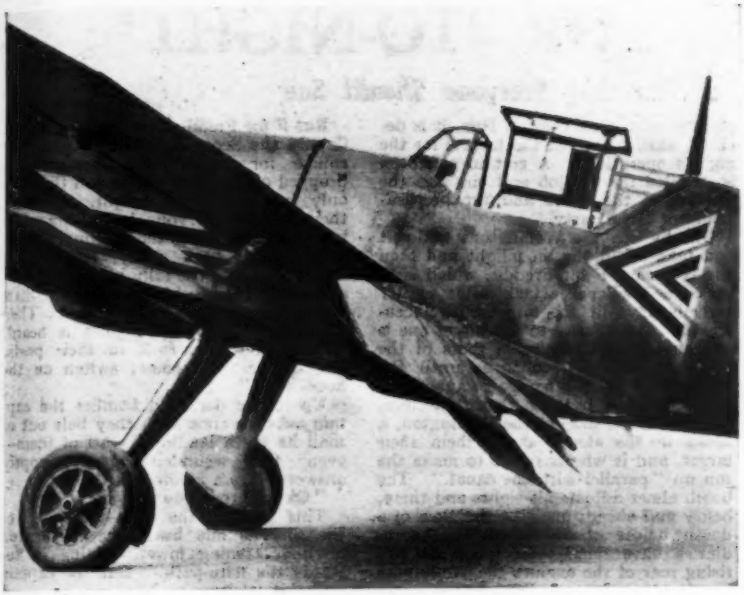
**SOME STROLL!: This R.A.F. pilot, having crash-landed in enemy country out East, disguised himself as an Arab and walked back to his squadron—a little stroll that lasted 14 days!**

ineffectiveness of the German bombers, irritating though their attentions had been. More evidence is now to hand to show that the effects of dive-bombing are more moral than material. An officer from Tobruk has made it known that air raids on that very gallant and energetic garrison have been more numerous than they have been on Malta. In fact, it seldom happens that Tobruk is for many hours without an air raid. The men of the garrison take the attacks calmly and fire steadily on the Stukas. Some 60 Stukas have been brought down, quite half of them by small-arms fire. One officer has brought down six with his own rifle. The casualties from the bombs have been negligible.

### Dealing with Dive-bombers

THAT is obviously the way to deal with the dive-bomber, to refuse to be overawed and to aim steadily at it with a quick-firing gun or rifle. The rifleman in a trench is as safe from a bomb as any soldier in the front line can expect to be. Artillery fire is far

**RED RETRIBUTION: Russian A.A. fire is proving very effective against German airmen, and here is one of their Maxim batteries, screened by foliage, awaiting a too-venturesome dive-bomber.**



**MESSY MESSERSCHMITT: The split trailing-edge flaps of the Me 109 F1/2, the latest achievement in German fighters, are divided into two sections as seen in this picture. The advantage of this untidy-looking arrangement is somewhat doubtful, especially on a fighter.**

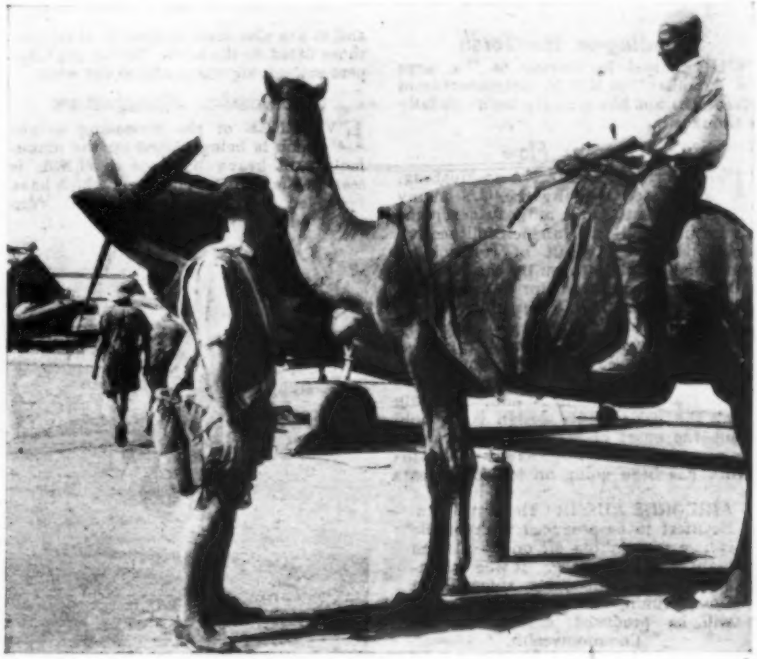
more accurate than bombing, especially against a small target, and experiences from the last war have shown how seldom even the accurate 5.9 German gun could land a shell right into a trench.

These experiences do not mean that the British Army ought not to have dive-bombers when it next takes the field. They are not always faced with the sang-froid which has been found capable of defeating them, and they have often silenced the fire of batteries and of infantry who are not entrenched, and also they have been effective against mechanised vehicles. They were mainly responsible for overcoming British resistance in Crete, where our infantry were not well entrenched. German troops are no more likely to be able to stand up against them than any other soldiers have been. And, when a British expeditionary force again faces the Germans on land, it is confidently hoped that the American bombers which will accompany them will prove of greater use (and less vulnerable) than the German Junkers 87.

A report has come from the Continent that the Germans would like to cut their losses in Russia, and stabilise that front until they have reached a decision against Britain. It seems hardly credible. The Russians are still full of fight, and a cessation of the German attacks would give them increased confidence. To hold their Eastern frontier against a Russian advance would mean that the Germans would have to tie up an enormous force along that line, which would have a most crippling effect on their powers for making a forward move in the West. No doubt the Germans reflect that in the last war they held the Russians in the East for over two years while they fought a ding-dong struggle in the West against both France and Britain. They may think that their great supplies of man-power would enable them to do the same again, especially as France is no longer one of their opponents. Perhaps something of that sort was in Mr. Churchill's mind when he warned this country to be ready for a possible invasion on September 1.

But without mastery of the air, the chances of an invasion of Great Britain are small, and now we are stronger than ever in numbers and in quality of fighter aircraft. Field Marshal Göring told his men that the conquest of Crete (where there was no effective fighter defence) proved that no island is unconquerable—but in his own heart he cannot believe it.

The Fleet Air Arm have made a dashing raid on Petsamo and on the neighbouring port of Kirkenes, both ports in Northern Finland which the Germans are now using. Evidently there were high expectations of success, for a fairly strong force of aircraft was sent to the attack. Little shipping was found at Petsamo, and the bombs had to be turned against the harbour works, which are not elaborate. At Kirkenes, some 40 miles to the west, a fast sloop, the *Bremse*, of nearly 1,500 tons, which is armed as a *flak*-ship, was hit twice, either by bombs or by torpedoes. There was intense A.A. defence at both places, and German fighters as well as guns attacked our aircraft. Three Me 109s and one Ju 87 were shot down, but our losses were 16 naval machines. This was a very daring exploit, and it deserved better results than it was able to achieve.



**CONTRAST IN TRANSPORT: The oldest and the newest forms of conveyance are both useful in desert warfare as shown by this picture of a camel and a Tomahawk fighter on a Middle East aerodrome. In the last war, incidentally, two kinds of camel were in use—the Sopwith Company designed one of them.**

# "TARGET FOR TO-NIGHT"

## *Here is a Film that Everyone Should See*

SHORT of impregnating the auditorium with the delicate odour of burnt lubricating oil, it would be difficult to imagine how a greater degree of realism could be provided by any film than is achieved by "Target for To-night." This is not propaganda in the sense usually implied by that overworked word; it is a faithful pictorial record of a typical night's work by the men of Bomber Command. It is dramatic and exciting, not because clever cinema technique and skilled acting have used their best trick to "glorify" the R.A.F., but because it portrays, without frills and without studio romanticism, a phase of Britain's fight against German aggression which is essentially dramatic and exciting. The cleverness of the producers of this film, in fact, lies in the very fact that they have not attempted to be clever, but have told the simple story in the most straightforward manner.

### Authentic

There are no professional actors dressed in sky-blue uniforms; every officer and man seen on the screen is a member of the R.A.F., and the cameraman made more than one trip over enemy territory, in a bomber, to get authentic raid pictures from the air so that the public might see for themselves just what our bomber crews have to face and what they so regularly achieve. It is safe to say that there has never before been a war film just like this one, but its value is such that one hopes others of similar integrity will follow.

The picture begins with the dropping of a parcel of negatives from a reconnaissance aircraft. These are hurried to the darkroom and on one of them is discovered evidence of new oil storage tanks, extended sidings and barge concentrations which were not present on previous photographs of the spot. This, it is decided, shall be one of the targets for the night's operations. A certain squadron is detailed for the job and one sees the briefing of the crews and the preparations for "the party."

One by one the Wellingtons taxi out and take off in the moonlight and then one is aboard F for Freddy, which is to make a low-level attack after earlier arrivals have lit the target with incendiaries. On its way to the target one is treated to some admirable shots of the bomber above a cloudscape until the tough little Scottish navigator announces that they are nearing their objective. Down goes the nose of the Wellington, a break in the clouds shows them their target, and it wheels round to make the run up "parallel with the canal." The bomb aimer adjusts his sights and there, below and ahead, one sees the glow of a dozen points of fire where the incendiaries have done their job. To the rising roar of the engines the Wellington streaks down in a shallow dive. With calm, expressionless face, the bomb aimer reaches out a hand and snaps down the selection switches; his eye lines up on the sights—"Right, right; steady!" His thumb waits over the release button; slowly, it seems, the target slides straight into line, the thumb squeezes down—"Bombs gone, sir!"

### Suspense

And down there, amongst the little fires and in defiance of the bursting flak and the streams of tracers whining up at the Wellington, one of the bombs bursts with a terrific flash right among the storage tanks. Then the Wellington lurches as a shell bursts mighty close; inside the machine the wireless operator falls from his seat. The pilot steadies his aircraft.

But F for Freddy now has no wireless. Calmly the Scottish navigator plots the course for home. Oil pressure has dropped on the port engine and they can only just hold their height. Back at their station everyone is waiting. No word from F for Freddy, but all the others come back safely, leaving one ominous gap on the tally board.

Nobody betrays his anxiety, but little is said. Fog begins to close down. Then at last the drone of engines is heard. Officers and men rush to their posts. "Yes, here she comes; switch on the floodlight!"

Up in the damaged bomber the captain asks his crew shall they bale out or shall he try a landing." All of them—even the wounded man—promptly answer "Try a landing, sir."

"Okay, cross your fingers!"

This is easily the most tense part of the film as one hears the Wellington circling, coming lower, gliding in towards the flare-path. But the captain makes it safely.

"Hope we haven't kept you waiting, sir," he says as he enters the interrogation room.

### Humour

There is humour in this film as well as drama. But it is the dry humour typical of the British fighting man and with no trace of film heroics. The only part that is necessarily "staged" is that which depicts Germans rushing frantically to their A.A. guns with cries of "Achtung! Achtung!!" and the ground shots of the blazing buildings and exploding tanks—scenes which, one has to admit, inspire a feeling of vicious satisfaction, as they are patently meant to do.

"Nice work," says the Group Captain when he hears the crew's report. This film is "nice work," too.

## *Handing-on the Torch*

THE arrival in Canada of "a large number" of R.A.F. instructors from Great Britain has recently been officially announced.

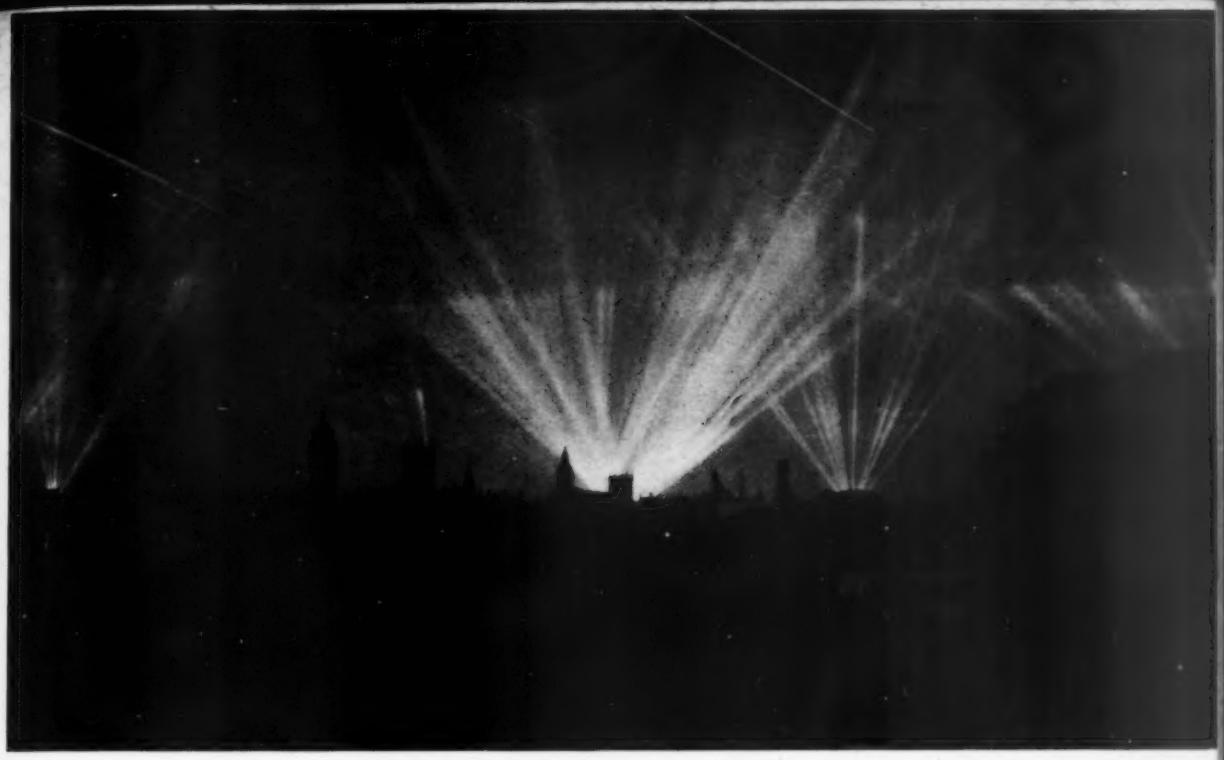
## *Laminar Flow*

THE North American NA-73 Mustang, designated P-51 by the U.S. Army Air Corps, is the first military aeroplane to be designed with an aerofoil section developed as a result of research in laminar flow undertaken by the National Advisory Committee for Aeronautics. Flow past an aerofoil section is frequently laminar near the leading edge and then becomes increasingly turbulent as the trailing edge is approached. No information on the new wing section has been released, but it is almost certain that the basis of its design is to hold back the onset of turbulence to a point as near the trailing edge as possible. This work has been going on for some years and it has also been applied to airscrews, those fitted to the latest Boeing 314 Clippers embodying the result of the work.

## *U.S. Bomber Manufacture*

EVIDENCE of the increasing weight which is being placed on the manufacture of heavy bombers in U.S.A. is seen in the value of contracts which have been let. Boeing, Douglas and Vega (the Lockheed subsidiary) will make Boeing B-17E Fortresses, and Consolidated, Douglas and Ford the Consolidated B-24 Liberators. War Department contracts let in June for four-engined heavy bombers total over $644,000,000 dollars (£161,000,000). The unit cost of this type will be about £50,000 or £60,000, so the order is apparently for about 3,000 bombers.

**AIRBORNE AUSSIE : The first Bristol Beaufort to be produced in Australia is here seen taking off on its maiden flight near Melbourne. It was assembled from components shipped out from Britain, but soon these aircraft will be produced entirely in the Commonwealth.**



Searchlights in action over London during last Autumn

# SPOTTING BY NIGHT—II

By Major L. E. C M. PEROWNE, R.E.

*IN this second half of "Spotting by Night," Major Perowne deals with the optical and mental processes which combine in detection. He gives a summary of the exercises to be carried out in training spotters, and the proper employment and use of binoculars is also dealt with in detail.*

THE combined operation of eye and brain which constitutes seeing or detection involves two quite separate and distinct processes, namely, Perception, by means of which a man's eye notices that there is an object to be seen; and Appreciation, by means of which his brain informs him exactly what is the object perceived. The first process answers the sub-conscious question, "Is there anything there?"; the second answers the question, "Is it an aircraft?"

In practice the eye sees principally what the brain expects it to see, but in aircraft spotting elements of confusion often make it difficult for the eye and brain to work together quickly and effectively enough. This element of confusion can be considered under these headings, viz:—

(i) *The Matter.*—Small object. Long range. Unusual appearance of an object magnified several diameters. Difficulty in knowing what the apparent size of the object will be. Alternative objects. Moths, clouds, spots in binoculars, etc.

(ii) *Its Presentation.*—Weak contrast between the object and its background. Low scale of illumination. Weak aspect. Glare.

(iii) *The Exposure.*—Brief and moving.

Visual training consists in developing the processes of perception and appreciation in the most aggravating conditions of confusion. It must be carried out both with and without binoculars.

### Visual Training

An essential of all forms of training is some means of checking progress, which in turn demands some system of standards. The basis of Visual Training is the standard eye test in which the standard eye is required to read quadrangular print $\frac{1}{8}$in. high at ten feet distance. The basis of instructing in Visual Training is a continuous and close relationship between the standards reached and those set in the exercises to be carried out. Hence any period of instruction, however short it may be, must begin with a test by the instructor:—

(*a*) Of the eye—by means of a test sight card.

(*b*) Of the instrument—by personal examination.

(*c*) Of eye and instrument together—by test sight card.

By the use of print we eliminate appreciation and confusion.

The exercises to be carried out in visual training consist in presenting the class with increasingly difficult tests of detection, gradually bringing the brain more and more into the work. Thus, starting from simple letterpress in which appreciation forms a small part we introduce confusion in twelve distinct stages:—

(i) Reduction of size. Increase of range. (The intermediate steps between sizes of print can be taken up by increase in range.)

(ii) Inversion. (Normally the eye, being accustomed to reading, only takes in the top half of a letter. By inverting it, we bring an unaccustomed view of the letter before the man.)

(iii) Jumbling, i.e., some letters the right way up, others turned sideways or inverted. (The brain now cannot continue in a set groove, but has to be constantly alert.)

(iv) Broken continuity. (We here introduce another unaccustomed circumstance, calling for further effort by the brain.)

(v) Superimposition of other irrelevant matter designed to carry the eye away from the object under view.

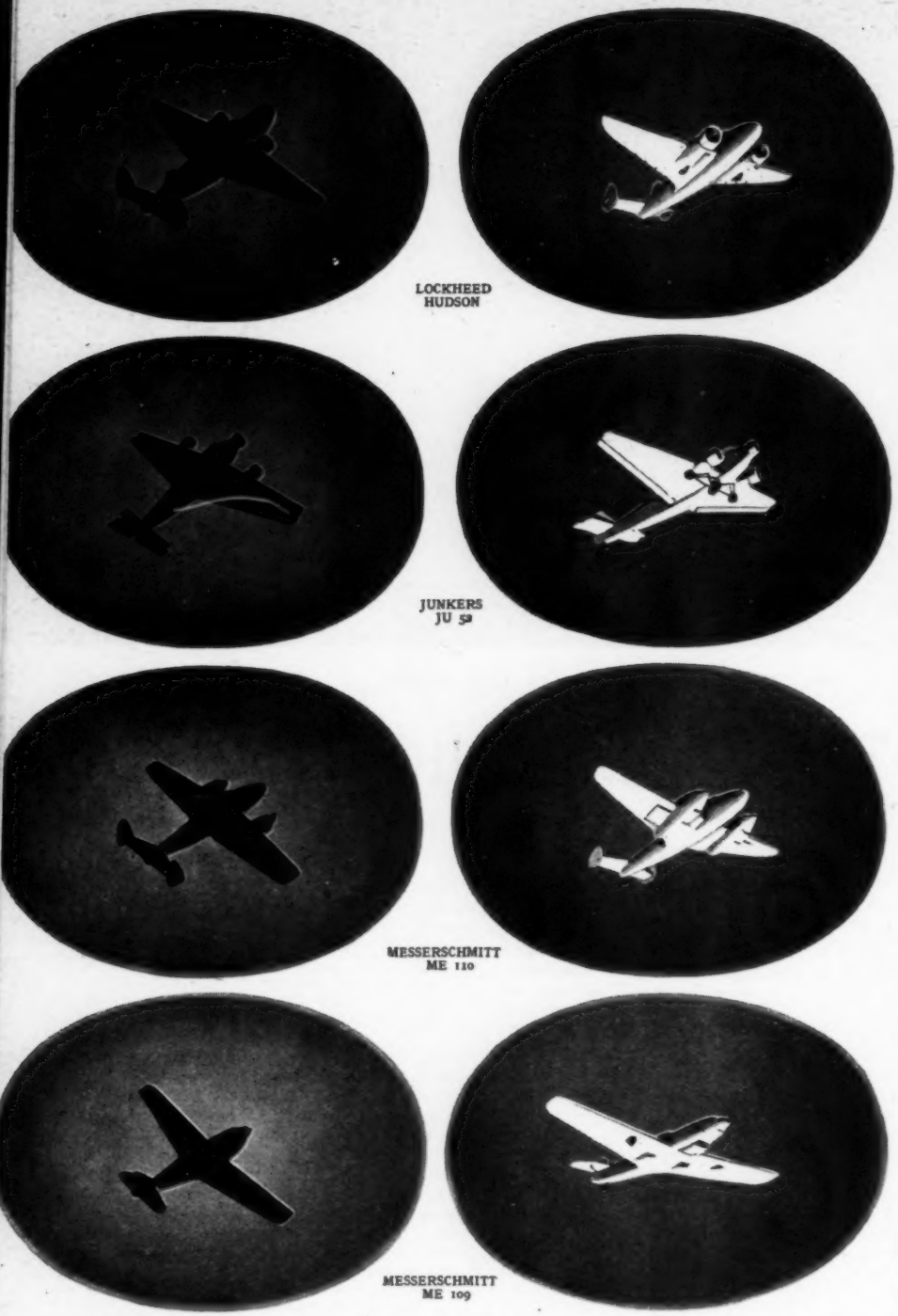
The above five stages are those affecting the *matter* itself.

(vi) Canting the card, thereby foreshortening the letters.

(vii) Distorting the card on which the letterpress appears, thereby calling for a continuous re-accommodation.

(viii) Colour and contrast.

(ix) Reduction of illumination. (Note the use in daylight of binoculars with diaphragms to achieve this end.)




**A MIXED BAG : Illuminated views from above and below of two enemy fighters, a German troop transport and our most frequently used Coastal Command type.**

(x) Glare. Introduction of light between the eye and the object.

These five stages affect the *presentation* of the object viewed.

(xi) Movement.

(xii) Reduction of time of exposure.

These last two stages affect the *exposure* of the object.

(The above twelve stages in the use of letterpress may be combined to produce not less than 500,000,000 separate exercises.)

It is now important to get the student away from the idea that the object of visual training is reading under difficult conditions The brain is now accustomed to expect print, and appreciation suffers accordingly. Hence the next step in visual training is the introduction into the exercises of objects which are *not what they at first sight appear to be*. Concealed letters and other matter designed to invite the question, "What is there that I do not at first see?" Success in this stage depends largely upon the extent to which the instructor can stimulate the man's brain in contest with him. If correctly done, we in this way combat careless vision. The man begins never to accept what he sees without close study for hidden detail. Design of this type of sight card is limitless, and all the stages of confusion can be introduced singly or in combination so that variety is endless.

We must now get the man away altogether from letterpress, which has hitherto been our sole means of checking results. The next step in visual training, therefore, consists in presenting to the man, either on cards or out of doors, objects or views inviting the questions: (i) What is it? (ii) How many are there? (iii) What are they?

### Binoculars

An expert has stated that it would require two years to make a man really proficient with binoculars, and that he could not guarantee to raise a pupil to the proficiency of a Highland ghillie with a telescope in a lifetime.

Binoculars are classified by field and magnification. The latter affects the standards to be expected. The field of view may vary in different glasses from 7 deg to 12 deg. The magnification of binoculars is marked (for example) "MAG 7" or simply "X7," implying "Multiply by 7." With binoculars X7 the standard eye should easily read $\frac{3}{16}$in. letter press at 70 yards. There are, however, certain points about the use of binoculars a spotter must know in order to achieve these results and exercise himself in telescopic vision. First, never focus binoculars on an object less than 70 yards distant when about to use them for long-distance work. For effective work the binoculars must be perfectly clean inside and out. Focusing should be done one eye at a time, not by closing one eye, but by covering the end of one telescope and focusing the other. The final adjustment is made with both eyes. Never strain the eyes; look naturally at the object through the binoculars with the muscles of the eye in the condition for unaided long-range vision.

By visual exercises with and without binoculars, carried out little and often, it is possible considerably to improve the otherwise intangible link between eye and

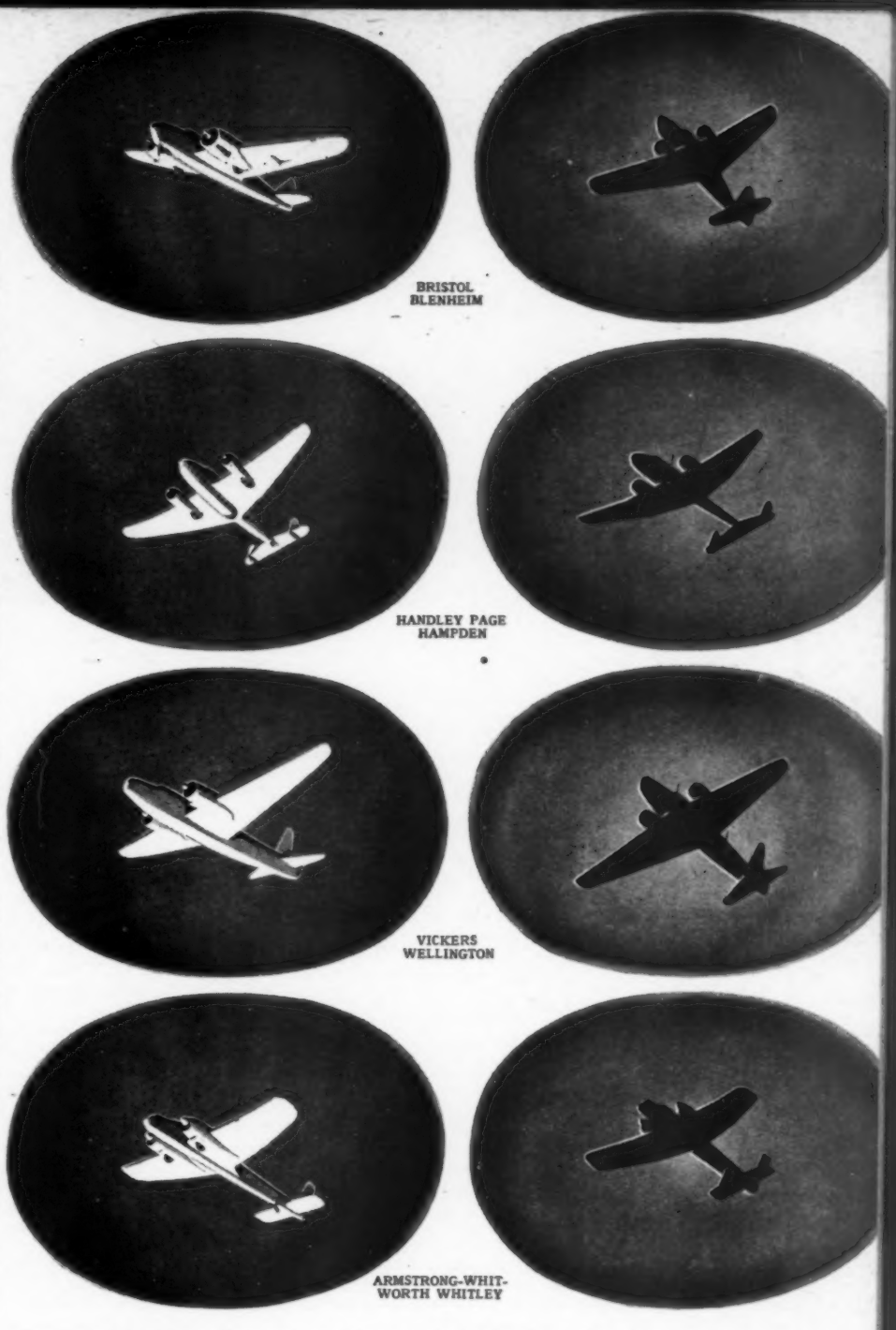
## Y NIGHT

brain which constitutes seeing. By the use of diaphragms with increasingly opaque filters in the object glass of the binoculars we can exercise the spotter, by day, in the combined effort of perception and appreciation of aircraft targets, in conditions of confusion approximating to those obtained in action at night.

### Scrutiny

It has been shown that small objects at extreme ranges and in difficult conditions of lighting require to be under observation for at least one second for the average eye and brain to detect their presence. All movements of the binoculars in searching an area of sky must therefore be carried out extremely slowly—in fact, at a rate not exceeding one field of view per second. An upward search such as that which we have shown to be required in the processes of location may mean a movement representing as many of three fields of view, each of which must be thoroughly scrutinised to ensure that the target is not in any one of them. Whilst scrutinising, the lateral movement must be continued to keep pace with the moving target. To scrutinise each field adequately requires one second for the trained eye so that the process will take five seconds at the least. Consideration will be given, when carrying out this process, to the direction of flight. A combination of the two movements needs considerable practice to attain proficiency.

To examine the field of view by day is a simple enough matter, but by night a phenomenon exists which must be appreciated by the spotter if he is to succeed. First, it must be realised that the eyes must be thoroughly dark-adapted (night efficient). It is estimated that from 12 to 40 minutes in complete darkness is required to attain an efficient degree of night adaptation. Night fighter pilots adopt the habit of wearing dark glasses when awaiting action by night. The more difficult fact is that, whereas by day visual acuity is sharpest at the point of fixation, by night the opposite is true. The portion of the retina known as the macular region, which by day permits sharpest visual acuity at the point of fixation, becomes blind when the eye is dark-adapted. This fact was discovered very early by astronomers, who observed that stars appeared unmistakably brighter if looked at eccentrically.




**BRITISH BOMBERS: Lighted outlines of four operational types in service with Bomber Command. Views of our newer heavies such as Stirling, Halifax and Manchester are, for obvious reasons, not for publication.**

So when scrutinising a field of view by night, in order to perceive an object more clearly in the right-hand half of it, it is necessary to look in the left-hand half. In order to minimise the risk of failure to observe a target which may just be leaving the field of view of the binoculars, scrutiny must be carried out scientifically.

The majority of targets will be approaching when engaged by a spotter and so the danger zone lies between nine and three o'clock of the field of view via 12 o'clock. If, therefore, he first looks at six o'clock, he examines first most clearly that region in which the target may be about to disappear from his view. Then, according to the direction of flight, left or right, he will scrutinise round the field via five or seven o'clock. The process is a rapid one and can be carried out successfully with practice.

# PILOT PRODUCTION

## *Primary, Basic and Advanced Training in U.S. Army Air Corps*

**THE RYAN PT-21 is the latest monoplane trainer to be adopted by the U.S. Army Air Corps. With a Kinner 132 h.p. engine its maximum speed is 123 m.p.h.**

THE U.S. Army Air Corps at the present time has a programme for training 12,000 pilots each year. This training is divided into three phases, primary, basic and advanced, each of which occupies ten weeks. It is directed from three centres: Maxwell Field, Alabama; Randolph Field, Texas; and Moffett Field, California. In each of these centres are numerous primary, basic and advanced flying schools.

Classes of approximately 2,400 pupils start the training course every five weeks. These young men, their ages ranging from 20 to 26, are enlisted as flying cadets and sent to one of the primary schools. These are civil schools under contract to the Army Air Corps, and are operated by civilians using Air Corps aircraft and equipment. Officers and enlisted men of the Air Corps are on duty in a supervisory capacity. Instructors are civilians who have been trained and have passed the Air Corps standards for instructors. The aircraft are usually biplanes, but the low-wing Ryan PT-20A monoplanes are also used. These have now been supplemented by the newer Ryan PT-21s and PT-22s.

Flying cadets at these civil schools live in barracks and get ground school and military training, in addition to their flight instruction. During the ten weeks at primary schools they have 60 hours' flying practice. Their first eight hours are devoted to dual instruction. After that they solo and go on to the more advanced practice. By the end of the 60 hours they are proficient at all fundamental manœuvres, including such aerobatics as loops, snap rolls and Immelman turns.

Basic training is also ten weeks in length, with 70 hours' flying time. First part of this stage is a repetition of primary. That is, the cadet is still learning to fly, but he now has a heavier and faster craft. After this preliminary phase, the cadets receive six hours of instrument flying, six hours of the fundamentals of three-plane formations, six hours of day navigation, night flying and transition to advanced type single-engine and twin-engine types.

Principal difference between the basic trainer and the advanced type aeroplane is a higher power engine and addition of retractable landing gear and constant speed airscrew as against the two-position airscrew and fixed undercarriage in the basic trainers. Third phase of training, advanced, occupies another ten weeks. This starts as a continuation of the transition to advanced equipment. As soon as proficiency has been reached on these, cadets then begin to learn how to use the aeroplane as a weapon. Some of the students are assigned to advanced single-engine schools, where they get pursuit formation, pursuit tactics and gunnery. The twin-engined type schools train pilots, bomb-aimers and navigators.

At the end of the 30 weeks the cadet has been transformed from a fledgling into a full-fledged bomb-aimer co-pilot. And he has acquired a very thorough technical knowledge of military aviation.

Of 100 cadets who start training, 55 to 60 of them complete the entire course. The others fall by the wayside because they lack the traits and ability that are required of a military pilot. Of the men who are eliminated, those who have the qualifications, who are deemed to be adaptable and who desire it, are given the opportunity of taking a special bomb-aimer's and navigator's course, and in other cases a meteorology, photographic, armament or engineering course.

The lengths of these courses vary from twelve weeks to nine months, depending on the type. Students retain their flying cadet status during this time and are commissioned as Second Lieutenants on completion.

Flying cadets are paid $75 a month, and are allowed one dollar a day for rations. Provided free of charge are uniforms, living accommodation and medical care. After graduation they get $245 a month when commissioned as Second Lieutenants.

The expanded pilot training programme started on July 1st, 1939. Up to that time the Air Corps trained 300 to 500 pilots a year. The first expansion called for a total of 5,500 pilots by July 1st, 1941. That meant 3,300 additional fliers. Long before this goal was reached a second expansion programme was started which called for 7,000 pilots to be trained annually. That rate was reached last summer, and immediately the schedule was stepped up to the training of 12,000 pilots annually.

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# BOOK REVIEW

*"The Aviation Mechanic," by Norcross and Quinn. McGraw-Hill, 21s.*

THIS copiously illustrated book—it has 537 blocks in its 563 pages—is not a textbook on the maintenance of aircraft but serves the very useful purpose of introducing to aircraft construction and maintenance work beginners who may wish to find out exactly what it is they are heading for when they elect to become aircraft mechanics. If they read all this book they will not be in any doubt, for it describes in great detail all the processes involved in building an aeroplane as well as the work of the maintenance shops of a modern airline. It also has a chapter on How an Aeroplane Flies, which is something which all mechanics should be interested in, even if they never have the opportunity to pilot one. Any mechanic who reads and digests this book will have a good general knowledge of aircraft work; for more detailed information he must apply to maintenance handbooks.

We must take the American authors to task for writing, "Forgings are made by pouring molten metal alloys into dies that serve as molds." This bad mistake is slightly alleviated by the next sentence which says, "The metal is then pounded by a heavy, hydraulically operated drop hammer." Authors of books of instruction such as this should remember that their words are taken very seriously by their readers whom they are initiating into aviation.

# D.H. TRAVELLING SCHOOL

**WRAPT ATTENTION : A class of R.A.F. ground staff, on whose knowledge and skill the efficiency of our fighting aircraft depends, are here seen absorbing useful airscrew information from a D.H. Instructor in the mobile classroom.**

JUST five years ago—soon after the early types of V.P. airscrews went into quantity production—the de Havilland Aircraft Company, Limited, established the first school designed and equipped to give instruction on the V.P. airscrew. It was housed at the company's Airscrew Factory, from which the first de Havilland-built airscrew had been delivered a year previously, on July 30th, 1935.

The fifth anniversary of the school this year is a somewhat special occasion, for now instruction is being carried to the pilots and engineers at their bases; and perhaps it may not be out of place here to record the early struggles of this educational centre.

In 1935-6 only the one type of V.P. airscrew was out of the experimental stage and in general use, and, although it was giving excellent service on the air lines and the "gear box of the air" had obviously come to stay, nevertheless the initial response was not so rapid as might have been expected in a go-ahead industry. The ancients were convinced that the earth was flat, more lately they declared that iron ships could never float, and as recently as 1936 the view was held in some quite influential quarters that the V.P. airscrew had no place in the composition of the modern aircraft.

### Modest Beginning

In these circumstances it is not surprising that the first series of courses by the de Havilland school failed to attract more than an enlightened few, and it was really not until the Empire flying-boats of Imperial Airways had demonstrated that here indeed was something new in aviation, something efficient, durable and revolutionary, that general interest began to awaken in this country.

From that time there has been an ever-increasing demand upon the present school's accommodation. Originally 10 or 12 pupils were catered for per week and now 50 to 60 are accepted, so that during the period under review over 4,000 pupils have received intensive instruction on all types of de Havilland airscrews. Most of this number have been Royal Air Force personnel.

### Overseas Instruction

In addition to educational work carried on in this country, members of the company's Service Department staff have been detached for considerable periods to give instruction in Poland, Czecho-Slovakia, Holland, Finland, Yugoslavia, Belgium and Turkey, where were demonstrated the whole practices of operation, maintenance and repair of V.P. airscrews.

Begun in 1936, this rather onerous business of taking the mountain to Mahomet in Europe was continued right up to the fall of France, when a party of instructors, caught up in the retreat from Paris, only evaded capture by a very small margin. From the first of these instructional courses careful records have been kept of the aptitude and examination results of every pupil; and the Air Registration Board, which from its inception has associated itself with the de Havilland Airscrew School, has co-opted its services as an examining body for ground engineers' licences.

Now de Havilland begin the sixth year of their educational endeavour by putting on the road a motor vehicle fully equipped to carry the instruction on V.P. airscrews wherever it is most urgently required throughout the country. This vehicle, which has accommodation for the optimum class of 12 to 14 pupils (the efficiency of the small class has been proved over and over again), is capable of demonstrating or illustrating the whole technique of the installation, adjustment, operation on the ground and in the air, parts interchangeability, maintenance and repair of all models of de Havilland airscrews, and its staff are qualified to diagnose irregularities and advise upon any aspect of operation and maintenance.

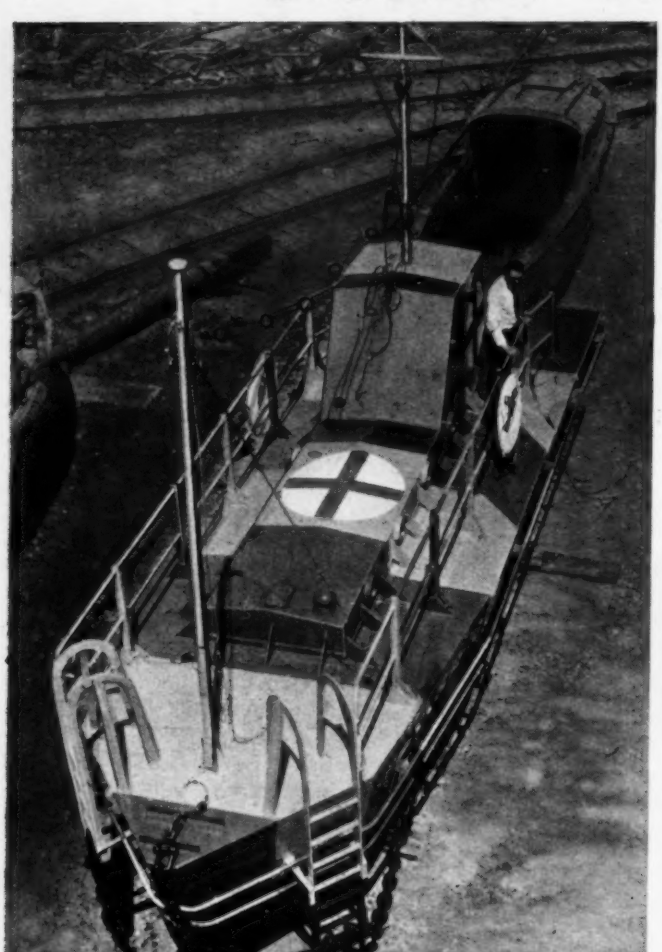
In addition to the sectioned airscrews and accessories, the vehicle carries a full range of tools and checking equipment, a large selection of specially prepared drawings and diagrams, a model to demonstrate the principles of airscrew balance, and a talking cinema apparatus; and to supplement the full library, which is constantly being added to, provision has also been made for the use of the Epidioscope, by means of which actual pictures or diagrams, or even smaller components and tools, can be shown on the screen from life.

### Official Approval

The vehicle has been prepared with the approval and assistance of the Directorate of Training, Air Ministry, and is already in commission on a long programme of visits to units of the Royal Air Force. It has accomplished much effective work already. It will travel all over the country and approval has been given to a scheme of introducing, between the tours to R.A.F. depots, short periods when the class-room will visit civil and semi-military establishments such as ferry pools, air-line maintenance bases and manufacturers' works which are equally concerned with the de Havilland airscrews, and particularly with the newest feathering types.

**STUDENT'S VIEW : Special diagrams and components with cut-away sections are used by the instructor as well as the blackboard to initiate his class into the details of a modern V.P. airscrew.**

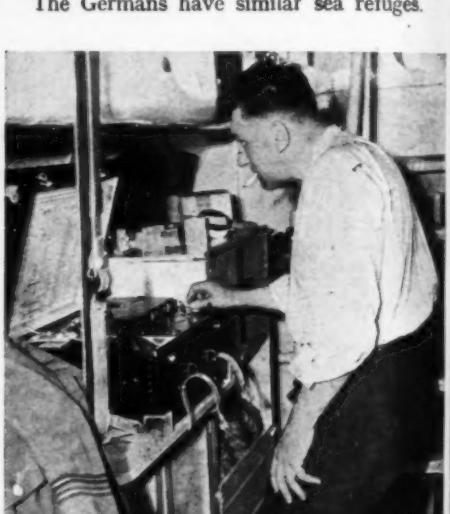
# OCEAN HOSTEL



## *New R.A.F. "Sea Shanties" Provide Every Comfort*

FLOATING rescue stations (left) are now being moored in the Channel for R.A.F. airmen who may be forced down in the sea. Built of metal and painted bright yellow and red to make them conspicuous, these "ocean hostels" are clearly marked with the Red Cross and are equipped, as these pictures show, to provide immediate needs such as first-aid kit, dry clothes, food, cooking stove, signals, wireless receiving set, books and cigarettes. The rail and steps make it easier for men who may be exhausted or wounded to get aboard.

The Germans have similar sea refuges.

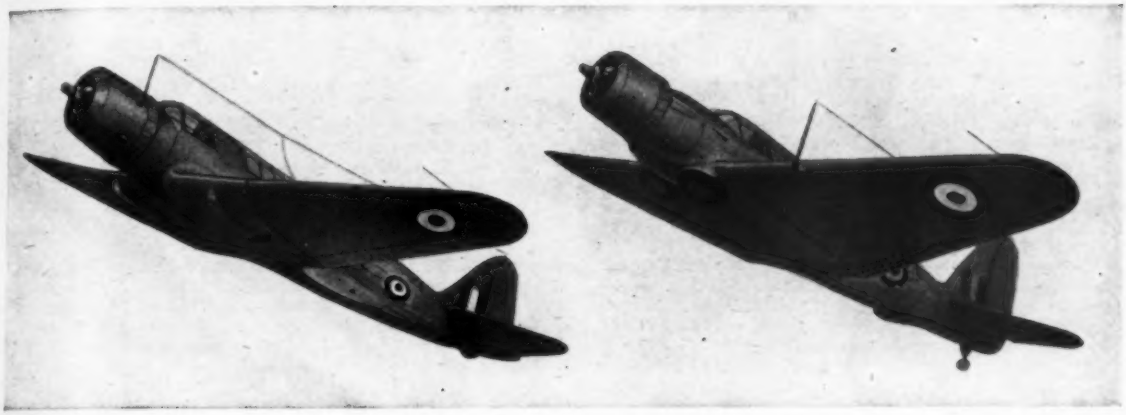


**Having donned dry clothes and lit a cigarette, the airman turns on the radio (top right) while he cooks himself a meal (bottom left) and then takes his ease with a little light reading (bottom right) while he awaits the arrival of a rescue launch.**

*Thirty-first of the Series*

# FRIEND or FOE?

## *Two American Dive-bombers · The Chesapeake and the Northrop*



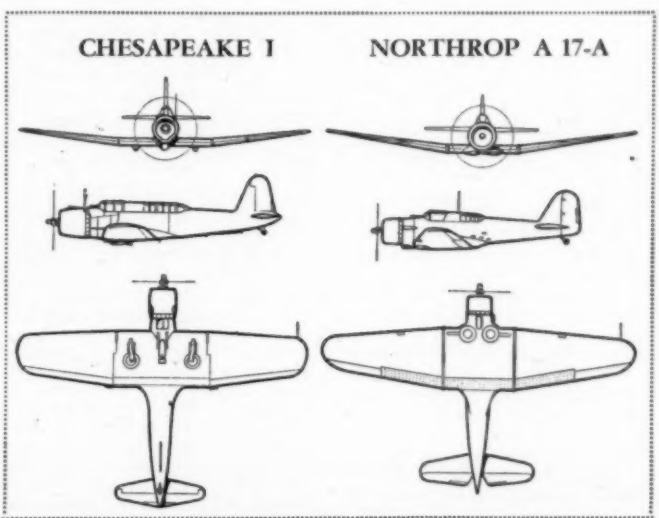
**VOUGHT-SIKORSKY CHESAPEAKE : Low-wing with taper and dihedral from centre-section. Radial engine, no spinner. Long, transparent cover over both cockpits. Undercarriage retracts backwards from leading-edge. Diamond-shaped tailplane. Tall, tapering fin and rudder with small, rounded apex.**

**NORTHROP A 17-A : Low-wing of similar plan to Chesapeake but set well forward with bulges at leading-edge roots to accommodate wheels of inwardly retracting undercarriage. Radial engine, no spinner. Wireless mast between covered cockpits. Sharply tapered tailplane. Large fin and rudder.**

BOTH these machines are well-tried designs, the Chesapeake having first flown in 1937 and the Northrop in 1936. The former was in production for the French Air Force early in the present war, but the orders were transferred to Great Britain when France threw in the towel. Its American designation is the VS-156 and, in its native country, it is classed as a scout-bomber. The Northrop A 17-A was also one of the first American types to be acquired when we needed more machines in a hurry, the first consignment being a batch released from service in U.S.A. and which were more or less obsolescent models.

As in the case of the Mohawk and Vanguard fighters described last week, these two dive-bombers so closely resemble each other that, when seen in the air under any but really helpful conditions, the chances of the spotter being able to recognise one from the other are decidedly slim—not that it matters much, since they both belong to the "friend" category—and he will need to be in a position to observe one or more certain small differences in design if he is to pin the right name on either of these machines. Even their respective wing plans are strikingly similar, both having a flat, parallel centre-section and outer panels with dihedral and taper on both edges. From the nose to the back of the second cockpit the two fuselages are almost indistinguishable from each other, except that the pilot's "office" is a little farther forward on the Chesapeake than it is on the Northrop; this, however, would hardly provide a means of establishing identity unless the two machines were seen flying close together. Aft of the cockpit cover, however, we find something much more positive and capable of fairly easy differentiation at respectable distances; as in the case of many otherwise very similar-looking aircraft, these two dive-bombers by no means match each other in the matter of tail unit design, as a glance at the G.A. drawings will show. Dealing first with the vertical surfaces, the fin and rudder of the Chesapeake form what may be termed an inverted "V" with a small, rounded apex, while those of the Northrop, which appear broader at the base, have a straight slope to the leading-edge, a well-rounded apex and a vertical trailing-edge. As for the tailplanes, that of the Chesapeake is set well back in relation to the fin and is a definite diamond shape. The Northrop tailplane, however, has a distinct "bite" between the elevators to allow movement for the projecting rudder; both edges are well tapered, but the root of the leading-edge is set level with the base of the fin.

From the head-on view the chief point of difference is supplied by the leg fairings of the Chesapeake's backwardly retracting undercarriage (of a similar type to that of the Mohawk described last week), which can be seen below the centre-section near where the dihedral begins. The wheels of the Northrop fold inwards, but are not completely hidden in their recesses when retracted and are set so near the leading-edge that it has bulges at the roots to accommodate their diameter.




*Next week: The Baltimore and the Martin B-26.*

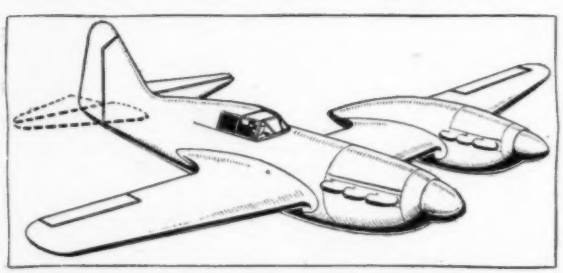
# ASYMMETRICAL AIRCRAFT

## *Patents Applied For as Long Ago as 1937 : Many Variations on "Loppy" Scheme Possible*

EVERY now and again one is forcibly reminded of the old cliché "There is nothing new under the sun." A recent case in point is the suggestion made by a *Flight* reader serving in the R.A.F. that drag might be saved, and performance thus improved, by placing one engine of a twin engined fighter in a fuselage and the other in a wing nacelle. We commented editorially on the idea in our issue of July 3rd ("Loopy" or "Loppy"?), and a sketch of such a scheme was given on page 23 of the following week's issue.

From readers all over the country we have had letters calling our attention to the fact, which was unknown to us, that some years ago the German firm Hamburger Flugzeugbau, G.m.b.H., patented such an idea. We imagine that most of the letters came from readers whose job it is in the different aircraft firms to study all aeronautical patents ; this would explain the unanimity of the reference to the Hamburger company's patent, and would also indicate that no other firm has taken out similar patents. To designer Richard Vogt, of Hamburger, thus must go the credit (or blame?) for the idea. And now let us examine the Hamburger patent.

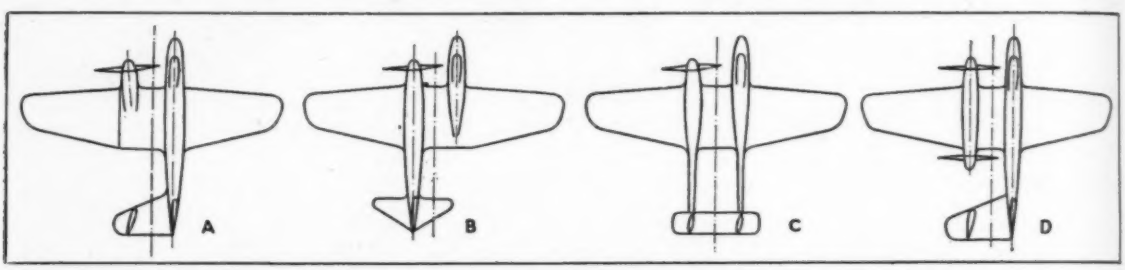
The British patent was granted in February, 1939, but the date of application goes back to December, 1937. It is, perhaps, significant that, although the patent specification mentions twin-engined aircraft, the invention refers particularly to single-engined aeroplanes, and it is claimed that the arrangement is an improvement on orthodox layouts. Four layouts are illustrated, and in all cases the centre-line of the wing lies between the fuselage proper and the wing nacelle, although not necessarily equidistant from them. That this must be so is obvious when one remembers the difference in weights of fuselage and engine nacelle.



"Loppy," the twin-engined asymmetrical aircraft suggested by an officer in the R.A.F. It certainly appears more promising than the German ideas.

To compensate for the offset of the airscrew thrust three methods are outlined. The airscrew thrust axis may be arranged at an angle to the longitudinal axis of the aircraft (in a horizontal plane). Secondly, the rudder and fin, lying in the slipstream of the airscrew, may be set at an angle to the longitudinal axis. And, finally, the leading edge of the tailplane may be set at an angle. Any one of these arrangements, or any combination of them, may be used on a particular aeroplane. For example, all three systems are embodied in type A, in which the engine is mounted on the wing and the pilot's cockpit is in the fuselage.

The centre of lift of the wing approximately coincides with the centre of gravity of the complete craft and lies between the fuselage and the engine nacelle. Should it be unavoidable, for any constructional or operational reasons, to separate the centre of gravity from the centre of lift, suitable location of the power unit would enable the torque reaction of the airscrew to be utilised to balance the craft. In type A, for instance, with the airscrew rotation clockwise as viewed from the rear, the reaction would tend to tilt the craft in the opposite sense. Such a tendency could be corrected by loading the fuselage.




Four asymmetrical arrangements patented by the Hamburger Flugzeugbau. One only is twin-engined. They may be compared with the suggestion shown below.

The ideal case would occur when the centre of drag is close to the centre of thrust, and the centre of gravity so spaced that it just balances the torque reaction of the airscrew. These conditions may well be realised in a single-seater craft in which the drag of the small fuselage is considerably smaller than that of the power plant and its cooling installation.

Type B shows a modified arrangement in which the power unit is mounted in the nose of the fuselage and a nacelle is located out on the wing. For this a symmetrical tailplane with a normal leading edge is employed and only the fin is set at an angle.

In type C both engine nacelle and fuselage are extended to the rear as booms supporting a normal tailplane and twin fins set at suitable correction angles.

For a twin engined craft there is no suggestion in the patent in question of mounting the second engine in the nose of the fuselage. Instead a tandem arrangement, as shown in type D, is proposed. The engines are apparently mounted with their axles parallel to the longitudinal axis, but in all other respects the craft resembles type A.

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### *U.S. Army's Air Freight Scheme*

STARTED in 1935, the Fiftieth Transport Wing of the U.S. Army Air Corps has now become in effect a "freight airline" and operates between such widely spaced towns as San Antonio (Texas), Los Angeles and Sacramento (California), Fairfield (Ohio) and the Panama Canal. Its fleet consists of about 40 Douglas C33 and C39 aircraft. These are cargo versions of the famous DC3 type, having specially large doors. Engines for repair and urgently required spares make up a large proportion of the cargoes. Airscrews are carried outside, fastened to the underside of the fuselage. The reduction of speed so caused is about 10 m.p.h. Up to 3,200lb. can be carried, but the usual load averages about 2,000lb. Official passengers are also carried. During the first half of last year nearly 3½ million lb. of cargo and 2,000 passengers were carried, and flying time totalled over 16,000 hours.

# THE GREAT DAYLIGHT ATTACK

## *An Official Account of the Preparations and Execution*

THE following account of the double attack on July 24th on the *Scharnhorst* and the *Gneisenau* was, says the Air Ministry News Service, not only the biggest daylight attack yet made by the R.A.F., but our bombers had to fly much farther from their base than the German bombers which attacked London and the South of England last autumn. They had to attack, with precision bombing, heavily armoured warships protected by six-inch armour-plating on deck, and each with 30 A.A. guns of her own. One of the battle cruisers was lying in the most heavily defended base in occupied France. Both ships were ringed with squadrons of Messerschmitts, and the entire attack was a typical example of the spirit expressed in the words of a squadron commander to his men, "Force your way in and fight your way out."

It was also a triumph of organisation. Each wave of heavy bombers had to use tactics appropriate to their type, each had to come in to the minute. Our escorting fighters were met at the exact moment of appointment and attacks hundreds of miles apart were absolutely punctual. So, too, was the arrival of successive formations over each single target. Height, method of attack, whether gliding or level, direction of entry, weight, selection and spacing of bombs—all had to be worked out and each instruction obeyed to the letter.

Such a battle is fought not only after hours of intensive preparation but also after years of research. The arrival of the American Fortresses at so great a height over Brest, a greater height than has ever been reached before on an operational flight, was the achievement of experts in half a dozen sciences.

At this level all the problems of high-altitude flying become acute. Doctors, aircraft designers and engineers of all kinds, in America and in England, spent many years in solving them. The supercharging of engines is a masterpiece of engineering. Above all, the human frame is subjected to an extraordinary strain both from the cold and from the rarefied air. At 36,000ft. the thermometer falls to minus 56.5 degrees Centigrade, though it goes no lower beyond that height.

### Pressure Chamber Training

The crews are given a course in pressure chambers before they begin to fly the Fortresses. In these chambers they regulate their own oxygen supply and are told to let themselves become unconscious for a few seconds at least once, so that they may realise that it is nothing to be frightened of and so that they may become extremely "oxygen-conscious." They must learn to pay attention to every detail of their oxygen-supplying apparatus while in the aircraft. A tingling just below the knee and in the ankles is the most common sensation while climbing to a great height, and above 20,000ft. almost everyone has a stomach-ache for a short while, even though he may take as much oxygen as he needs. The gunners and any others who have to do heavy manual work give themselves more oxygen than the others; they take as much more as if they were 5,000ft. higher than the rest of the crew.

Unless the stream of oxygen is adequate the arms and legs grow weak and there is no co-ordination of movement. The effect of height on the mind is not realised by the airmen themselves, and unless they are careful they may become over-confident and lose their sense of time.

The crews were briefed soon after breakfast and then immediately changed into their flying kit. The men in the rear of the aircraft, where they would feel the cold more, wore special electrically heated clothing.

"The air," one pilot said, "was as clear as a bell and we could pick out the French coast a good half-hour's flying time before we reached it. Over the Channel there seemed to be no horizon, and you couldn't distinguish sea from sky, both were perfectly blue and we seemed to be flying in a great blue ball of space. Then miles below and in the far distance I saw a sandy smudge. That was France. At first the fields beyond were vague on the horizon, but when we got over them they looked like a tiny irregular draughts-board in brown, yellow and green. In fact, France looked like our maps in the briefing room. Brest, when we got over it, was no bigger than my thumb. It was so cold that white frost was a quarter of an inch thick on the astro-hatch and we had to open the front Perspex windows; there was so much rime on them they were opaque."

Down below the Fortresses a fierce battle raged and further south there was a fierce battle over La Pallice. Even while the anti-aircraft barrage from Brest was at its height a great many Messerschmitt 109s attacked the Hampdens which came in in tight formation, while the Fortresses were still overhead. The Hampdens shot down at least three of the enemy and probably one more. One Hampden and one Messerschmitt opened fire at the same moment. The Messerschmitt turned over on its back, but went on firing and hit the Hampden's wireless and its inner port tank. But the Messerschmitt went down in a steep dive and the Hampden's bullets pursued it. It tried to pull out at about 1,000ft. but never came up and hit the ground on the coast. The crew of one aircraft saw a Hampden falling towards the sea and at the very same moment a Messerschmitt falling north of Brest and bursting into flames.

### Wellingtons versus Messerschmitts

A little later the Wellingtons were engaged. One had to meet a fierce attack by two Me 109Fs. The Wellington destroyed one and badly damaged the other. Yet another Me fell like a stone after an engagement with a Wellington, and, as it fell, our rear gunner fired 150 rounds straight into its belly. It hit the ground and exploded. In another combat a large part of the fuselage of a Wellington was set on fire. While the crew were struggling to smother the flames, the pilot's harness caught in the control column and the bomber began spinning down. The pilot, however, managed to regain control at almost sea level. The bomber landed in England, and by then so much of the fabric had been burnt away that it was almost a skeleton.

Though combats seemed to follow one another in an unending succession, and though as many guns were trained on our aircraft in broad daylight as in any of the previous night attacks on Brest, nothing could check the drive and impetus of the assault. Seven direct hits with heavy armour-piercing bombs crippled the *Gneisenau* and immense damage was done to the dockyards at Brest.

The crew of the Halifax which got a direct hit on the *Scharnhorst*, moored to a breakwater at La Pallice, saw a pillar of black smoke rise a thousand feet from the deck. But they, like the crews of all the other Halifax's, had to meet intense opposition, and themselves drove off two Me 109s which made a fierce attack.

The rear gunner of one Halifax was wounded by a Me bullet. The wireless operator crawled to the tail turret and took the gunner's place. He had only just sat down in the turret when another Me attacked from dead astern. The wireless operator trained his guns and shot so well that the Messerschmitt dived vertically down and was lost to sight. In another Halifax both wireless operator and engineer were wounded by an enemy fighter's guns. Although the engineer had severe wounds in head and shoulder, he directed the crew in work which he had not the strength to do himself, and when the Halifax landed refused to leave it until the normal landing drill had been completed.

The attack by a strong force of Blenheims on the harbour of Cherbourg must be regarded as an important part of the day's work. In the course of the attack, made against very heavy anti-aircraft fire, an important whale oil ship was hit and set on fire.

Dr. F. W. Lanchester, the "Grand Old Man" of British Aerodynamics.

# ROCKET PROPULSION—I

## *The Rocket as a Simple Form of Thermodynamic Engine. Has it a Future?*

By F. W. LANCHESTER

*THIS article was written some six months ago, but we have not had space to publish it until now. Recently Lt. Col. Moore-Brabazon spoke to a distinguished gathering and warned them not to remain content with thinking of the petrol engine and airscrew as we know them, but to consider other possible developments. Whether or not the new Minister for Aircraft Production had in mind some form of jet propulsion we have no means of knowing. Be that as it may, Dr. Lanchester's article deals with a fascinating subject, although his conclusions are not encouraging when applied to general propulsion. A second article will deal with "boost" for short periods*

IN an article contributed to *Flight* of August 8th last year under the title of "Boost," the writer dealt incidentally with the application of the rocket to the propulsion of an aeroplane during the period of "take off." The present article is concerned with the problem of rocket propulsion in more general terms. It is, in the first place, necessary to summarise in review some of the ground already covered, going back to the articles and discussion which appeared in *Flight* in November and December, 1939; that must form the ground work.

The rocket is in its essence the simplest possible form of thermodynamic engine; as such it comprises a pressure tight vessel or case furnished with an escape nozzle, and filled with or containing a pyrotechnic composition which is a self-contained combustible mixture that does not need to be supplied with oxygen from without. The products of combustion are ejected at considerable pressure and correspondingly high velocity, and a portion at least of the heat of combustion appears in the form of kinetic energy in the issuing gases. In accordance with the second law of thermodynamics only a part of the heat energy can be transformed to do mechanical work, a part remaining as heat in the discharged gases, which corresponds to the exhaust of a gas or petrol engine. Also some of the energy is lost as heat to the walls of the case and the nozzle, and in skin friction. The point of importance here is that the rocket is a heat engine, or thermodynamic engine, and subject to the same fundamental laws and limitations as heat engines of other kinds. The kinetic energy of the issuing gases per unit time represents the i.h.p. of the engine, and the relation of this to the total energy of combustion (in like terms) gives the thermal efficiency. But this is not the whole story. In its application the kinetic energy of the efflux is not used in a direct manner, as would be the case if the nozzle were adapted to drive a pelton wheel or other form of direct-impulse turbine; the work done (or energy) is derived from the recoil, and it is only when so applied that this particular form of heat engine becomes in the full sense of the word a *rocket*.

### Efficiency Re-defined

The work done by the recoil as calculated *on the understanding that the body propelled loses no weight* is, generally speaking, *less* and can never be greater than the kinetic energy of efflux. This, however, involves a fallacy—*the body propelled does lose weight*, and when a rocket is used as an instrument of propulsion the composition contains, in addition to its chemical energy, the *kinetic energy due to its velocity as part of the body propelled*; the body propelled loses this energy and it becomes available for the purpose of propulsion, as an analysis given by the writer in his previous articles has demonstrated, and which is, in its simplest form, as follows:—

Let $V$ be the velocity of flight (ft./sec.) taken as uniform.
" $F$ be force of propulsion (poundals).
" $m_s$ be mass per second of efflux gases passing nozzle (lb.).
" $v$ be efflux velocity (ft./sec.).

Then, Work usefully performed, per sec. $= VF = Vm_sv$

and, Work done (kinetic energy in efflux) $= \frac{m_sv^2}{2}$

$$\therefore \text{Efficiency} = \frac{\text{useful work}}{\text{work done}} = \frac{Vm_sv}{m_sv^2/2} = \frac{2V}{v}$$

This is a result which gave rise to much fevered hostility when originally presented.

Before going further we will study the rocket as a heat engine, apart from its mode of application. The first and most important observation is that the case, the composition and the nozzle form a self-contained system. The rate of combustion is not dependent upon any external conditions*. Equilibrium is established

*In reckoning pressure, external pressure must be taken as datum not true zero.

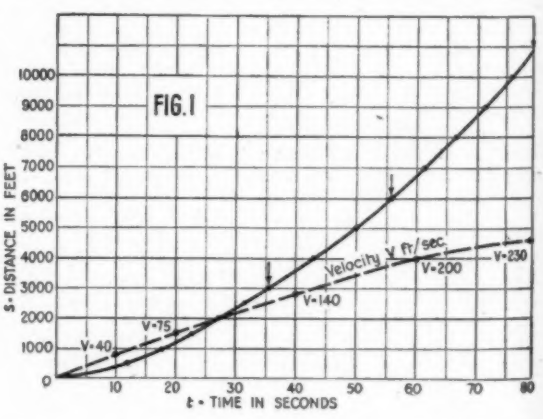



Fig. 1. Basis of plotting efficiency curve: The mean efficiency is $2\,S/v\,t$. Taking $v=6{,}000$ and three values of S as examples, viz., 3,000ft., 6,000ft. and 11,000ft., the corresponding efficiencies are, after $t=35$, 56.5 and 81 seconds, $\frac{2\times3{,}000}{6{,}000\times35}=0.0285$; $\frac{2\times6{,}000}{6{,}000\times56.5}=0.0300$ and $\frac{2\times11{,}000}{6{,}000\times81}=0.442$ respectively. If V, the velocity of flight, remains constant after that, efficiency $=\frac{2V}{v}=\frac{460}{6{,}000}=0.0766$. These three points are indicated by arrows.

when, at some pressure within the case, the rate of efflux mass per second is equal to the rate of combustion in like terms. The efflux velocity, so far as concerns the ballistics of the heat engine, is measured relatively to the case and not with reference to any external object or datum point.

This may be expressed in other words by saying that the ballistics of the thermodynamic system, like those of a gun, are not affected by translational motion of the case and contents as a whole, and the work done in generating the efflux is constant and dependent only on the energy set free by combustion as above set forth. If this were not so, a rocket might be used as an instrument for determining the motion of the earth in its orbit or in the limit the observer's absolute motion in space, which is of course absurd. This tells us that, the rate of combustion being uniform, the work done by the rocket as a heat engine, as measured by the kinetic energy of the efflux, *is constant as a function of time*. And this, if we like so to express it, *the h.p. of the rocket*, is the same in whatever manner the rocket is mounted or used.

We therefore appreciate the truth of the expressions given above for the *work done*, as that generated within the rocket case, per second, namely, $m_s v^2/2$ and $2\,V/v$ as the *efficiency*. Now when $V = v$ the *efficiency* = 2, or 200 per cent.

### A Simple Illustration

Let us see what this means; the efflux gases which (as composition before combustion) were travelling with the velocity $V$ are now left *stationary*, relatively to the body propelled. In other words, they have surrendered energy at the rate of $m_s V^2/2$ foot poundals per second. Let us assume that by some unspecified means† this energy be restored, then the energy balance for propulsion will be, $Vm_s v - m_s V^2/2 = m_s V^2 - m_s V^2/2$ (since in this special case $v = V$), giving $m_s V^2/2$; efficiency is, $\frac{2m_s V^2}{2m_s V^2} = 1$, which is just what it would be if the available energy were that provided by efflux alone. This might be generalised for other values of $V/v$ but as an illustration the simple case as given is sufficient.

So far we have gone over the old ground based on propulsion at constant or uniform $V$, with special attention to the elucidation of the "paradox" which need no longer trouble anyone. The writer will now deal with the more general case of $V$ (flight velocity) being variable. As a typical condition that of a rocket starting from rest will be examined. The importance of this is that, if we start from rest, the whole work has to come from the rocket, and there can be no credit taken on account of the loss of mass, for, if we start at the beginning the kinetic energy must be imparted to the body propelled before it can be made use of, so that if we make up an energy account *ab origine* to any subsequent point in time and space, there should be perfect balance, and the mean calculated efficiency should be free from paradox.

Let us suppose the body of an aeroplane divided into two compartments by a bulkhead, and in the after compartment let the rocket or recoil engine be installed. This is the engine room, and let us suppose there to be an engineer in charge, who has no means of knowing what is going on outside; then by suitable instruments we may credit him with being able to measure the power output represented by the efflux stream. A pilot in the fore compartment is provided with means of measuring the thrust $F$ and the velocity $V$, but otherwise knows nothing of what is taking place in the after compartment.

When these two put their heads together they can calculate the efficiency of propulsion in the manner given above. Furthermore, when the pilot, or someone on his behalf, can take records of distance flown (as by an electrical chronograph) as the plane gains speed on the runway the overall or average efficiency is readily obtained. Thus, referring to Fig. 1, in which the results of observation are supposed plotted, and in which ordinates stand for *distance* and abscissae *time*, the work done (motor output) depends on the time of flight, and the work performed depends upon the distance flown from rest at o.

There is no definite relation between distance and time of flight, it depends amongst other things upon the nature of the resistance from point to point as affected by gradients or other natural obstacles; as the result of observation the graph illustrating the relation is arbitrary and would lend itself only to graphic solution.

If plotted to appropriate scales the efficiency is given by the distance $S$ in terms of the time $t$, namely $S/t$, giving the mean value dating from the origin o, the point of departure. Thus the work done usefully in propulsion $= SF = Sm_s v$, and the power output from the rocket in time $t = m_s v^2 t/2$. Hence efficiency is given by the expression,

$$\frac{Sm_s v}{m_s v^2 t/2} = \frac{2S}{vt}$$

This applies to any conjugate values of $S$ and $t$, $v$ being as before the efflux velocity; and the expression holds good whatever the nature of the resistance may be, i.e. whether it be due to gradients or obstacles of any kind or to inertia, in whole or in part.

For theoretical discussion the most interesting case is that in which the whole force of propulsion is devoted to overcoming inertia, and although this condition is in the main academic it is not devoid of practical importance. The ordinates and abscissae are then related as in the well-known formula of the falling body, $2S = gt^2$, but with the symbol $f$ substituted for $g$ as denoting acceleration in a general way, and not any prefixed value. Then $2S = t^2 f$ and the efficiency equation as above may be written, $t^2 f/vt = tf/v$, where $f$ and $v$ are constants.* (Fig. 2.)

### Quantitative

The quantitative treatment of the problem of rocket propulsion needs to be based on the conception that the rocket composition is the fuel, and that the rocket itself is a thermodynamic engine. Also that the mode of pro-

†If the "unspecified means" implies taking energy from the body propelled the thrust $F$ would only be half what it would be by hypothesis, and to produce the full thrust we should have to develop twice the power in the rocket "heat engine."

*This is not strictly true other than locally; for the plane is losing weight owing to the gradual consumption of the "fuel" (the rocket composition) and the force (the recoil) is assumed constant. Hence the acceleration is increasing during the "take off" stage. We are not entitled to regard this as negligible for it is this very fact that provides a great part of the energy of propulsion, as has been shown, and on a "take off" it may, from first to last, account to some five or ten per cent. of the rocket "fuel," but it is a small matter in comparison with the effect of adventitious resistance, and may therefore be disregarded.

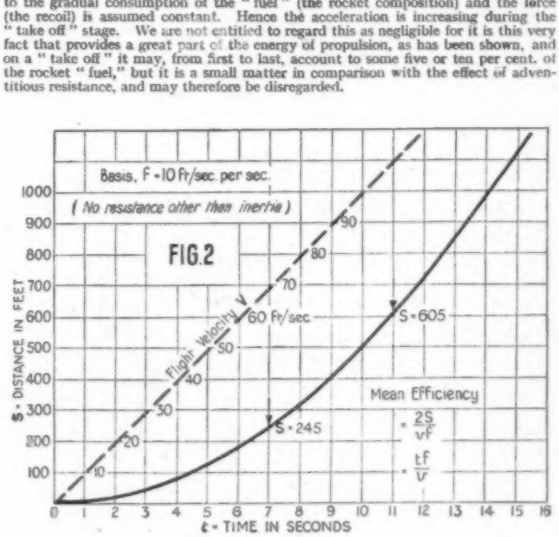



Fig. 2. Mean efficiency 1a $\frac{2 \times 250}{6{,}000 \times 7} = 0.0117$; 2a $\frac{2 \times 605}{6{,}000 \times 11} = 0.0183$; 1b $\frac{7 \times 10}{6{,}000} = 0.0117$; 2b $\frac{11 \times 10}{6{,}000} = 0.0183$.

pulsion by recoil is subject to the generalisations relating to efflux propulsion as laid down by the writer. Concerning the *fuel*, a comparison with the fuel most used to-day, petroleum spirit or petrol, is illuminating.

A good rocket composition contains the same ingredients as black powder, but in rather different proportions, thus :—

| | per cent. |
|---|---|
| Charcoal (practically pure carbon) .. .. | 25 |
| Nitre ($KNO_3$) .. .. .. .. .. | 58 |
| Sulphur* .. .. .. .. .. | 17 |

The nitre provides enough oxygen to burn the carbon to form carbon monoxide CO (but *not* $CO_2$), and one lb. carbon so combined liberates 4,400 B.Th.U. = 3,400,000 ft./lb. work. That is, for 1 lb. of composition as above, 0.25 × 3,400,000 = 850,000 ft./lb. The writer, in a recent article, gave it as 1,000,000 ; he believes that to be an over-estimate.

It is difficult to assess the thermal efficiency of a rocket considered as a form of internal combustion engine ; the theoretical figure must be very high, in view of the fact that the " compression ratio " (if one may be permitted to use that term) is in the region of 500 or 1,000, the volume of the solid fuel being so small in relation to the final volume of the gases ; also the negative work is nil ; there is nothing to deduct for compression.

On the other hand, the direct heat loss must be considerable, and the nozzle losses in part due to skin-friction are by no means negligible. The writer is not acquainted with any attempts to investigate the matter experimentally, but as a *guess* based on general experience he is prepared to allow a thermal efficiency covering all these items as ⅔ or 66.7 per cent. ; this gives 566,000 as the energy in foot-pounds per lb. as available in the efflux jet. Then the efflux velocity $v = \sqrt{2g \times 566{,}000} = 6{,}000$ ft./sec. approximately.

*It is said that sulphur is necessary as exercising a moderating influence on the speed of combustion.

### Range of Flight : A Comparison

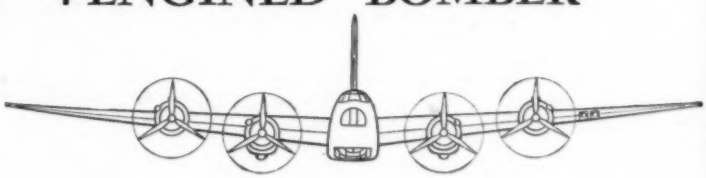
When considering the range of flight the short spell of " take off " is a mere incident, and its influence on fuel consumption may be ignored, especially when instituting a comparison. So we may revert to the condition of constant flight velocity.

Now taking the flight velocity $V = 600$ ft./sec., (about 400 m.p.h.) a figure typical of the fast fighter plane of to-day ; the rocket efficiency $(2V/v)$ is 1,200/6,000 = 0.2, giving 0.2 × 566,000 = 113,200 ft./lb. per lb. of rocket composition available for propulsion. Comparing this with the standard method of propulsion using petrol as fuel, one lb. of petrol yields 15,000,000 ft./lb. Assuming a thermal efficiency of 0.33 this gives 5,000,000 " on the indicator," and if we take the mechanical efficiency and propeller efficiency (lumped together) as 60 per cent., the energy available for propulsion will be 3,000,000 against 113,200 in the case of the rocket, the ratio thus being 26.5 to 1.

Thus a range of 4,000 miles in a plane propelled by petrol engine and screw propeller would be reduced to 150 miles if rocket propulsion were to be substituted. In the face of this, for the general purposes of propulsion the rocket has no future, whatever other services it may be able to perform. No allowance for the saving of weight of engine and propeller could make such a difference as would put the comparison in a better light. In a future article the writer proposes to give further consideration to the rocket as a means of " boost " both when taking off and when a burst of speed is desired beyond the power of the motive power installation.

# OUR NEW 4-ENGINED BOMBER

## *Further Details, and First Drawings, of the Short Stirling*



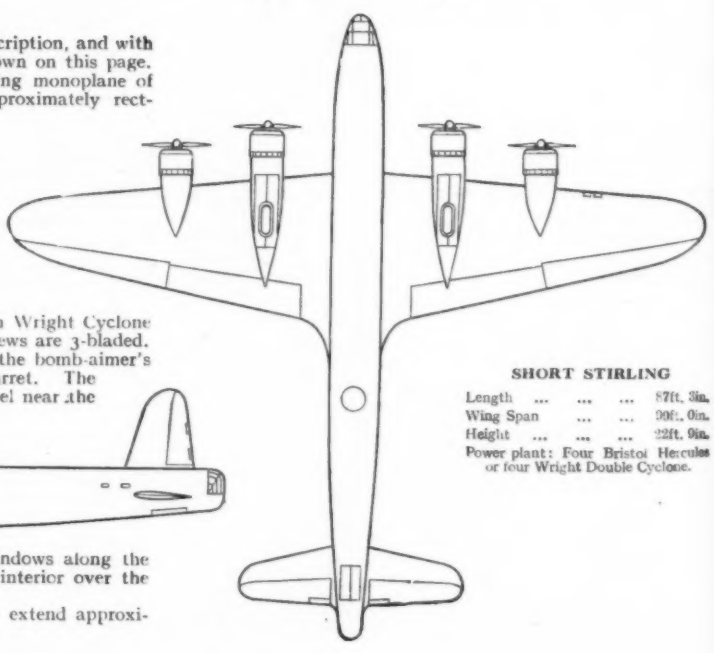
OFFICIAL photographs of the Short Stirling heavy bomber were released recently, and were published in our issue of last week. Now we are able to supplement them with the following brief description, and with three-view general arrangement drawings shown on this page.

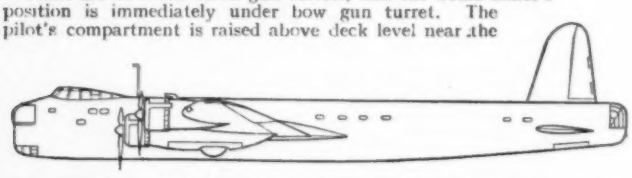
In general design the Stirling is a mid-wing monoplane of tapered plan form, with a fuselage of approximately rectangular cross-section, a single fin and rudder, four radial engines mounted on the leading edge, and retractable main undercarriage and double tail wheel. A slightly unusual feature is the engine placing, the two inboard engines being underslung and set ahead of the outboard engines.

Although always radial air-cooled engines, the power units may be four Bristol Hercules 14-cyl. sleeve-valve engines of 1,400 h.p. each, or four American Wright Cyclone double-row poppet-valve engines. The airscrews are 3-bladed.

There are bow and stern gun turrets, and the bomb-aimer's position is immediately under bow gun turret. The pilot's compartment is raised above deck level near the nose, well forward of the airscrews, and windows along the sides of the fuselage provide a well-lighted interior over the whole length.

The bomb doors (not shown on drawings) extend approximately half the length of the fuselage.





**SHORT STIRLING**

| | |
|---|---|
| Length ... ... ... | 87ft. 3in. |
| Wing Span ... ... | 99ft. 0in. |
| Height ... ... ... | 22ft. 9in. |

Power plant: Four Bristol Hercules or four Wright Double Cyclone.

*Topics of the Day*

# STILL GUESSWORK

## *One Day We Shall Learn Something About Airflow : Strange Effects Near the Ground*

IF one judges only from the extraordinary variations in aircraft design it can only be said that the whole thing is, as I have remarked *ad nauseam*, very much a hit-and-miss affair, with, however, as rule-of-thumb information increases hour by hour, far more hitting than missing. We are learning like a blind man who slowly discovers his way about a black world. And we are blind, because nobody has yet discovered a way of seeing the air, and apart from somewhat inconclusive wind-tunnel tests every new type is by way of being a shot in the dark—though a shot fired with the experience gathered in innumerable previous shots in a roughly similar direction.

One has only to look at the pictures of some of the more recent types to realise how much guesswork there is. A higher performance is often obtained in one type by carrying out modifications which have been discarded in another to obtain a similar performance increase. In recent months such strange anomalies have been more apparent in German types than in our own, but that does not mean to say that we are not all working on much the same lines of hopeful development and change.

### Hard-won Speed

It is so easy for the non-technical Press to talk calmly of fantastic speeds or increases of speed. Anybody who has caught his arm in the slipstream of a fighter while closing or opening the hood will know exactly what air means at speeds around even the two hundred mark. The air is solid, like a wall, and extra speed can only be obtained in small quantities by the exercise of wit, ingenuity and, above all, care in detail. To add twenty miles an hour above even the two hundred mark is a phenomenal achievement unless other features have been sacrificed or the available power increased by a prodigious figure. Even if the most conservative figures are used, our latest types make one fairly hopeful of the future.

Of course, a great deal of the credit must be taken by the engine manufacturers. The available outputs—available with safety at least for comparatively long periods—are becoming enormous, and it is becoming usual nowadays to take very little more than two-thirds of the power for normal take-off purposes, while in the old days the unfortunate engines were simply bursting with every obtainable b.h.p. to get the aeroplane off the ground, after which the pilot throttled back with a sigh, as much as to say, "Well, *that* much will not have to be used again until we leave the ground." Pilots are learning to take off on the boost gauges or by opening up only to a predetermined throttle position, fixed by a gate—the rest can be used in emergency or when the hunt is really on. But it is there, and that's the point. A little later the emergency, or "tally ho!" boost will become normal and the gate will be moved farther up the quadrant.

### Easier to Fly

Neither are aeroplanes becoming more vicious nor more difficult to fly, though such is the price one would expect to have to pay for the necessary increased performance in wartime. They are, of course, more complicated and demand a technique which must be thoroughly understood, but the actual business of flying appears to be, if anything, easier. In fact, it's no earthly good producing vast quantities of very effective aeroplanes which *are* vicious, because they must be flown by pilots with comparatively little experience and the wastage would be tremendous. Aeroplanes can be replaced with comparative ease, but pilots certainly cannot—as the opposition will eventually discover.

There is a curious tendency to imagine that Germany has unlimited man-power and unlimited enthusiasm. Man-power is irreplaceable and enthusiasm fades. Nobody, not even Dr. Goebbels, can prevent all the mothers and wives and lovers from realising that their losses are irreplaceable and enormous. People get together and discover that wars are not won without tragedy on a gargantuan scale and that the gains are usually ridiculous by comparison. Not all the propaganda and enthusiasm in the world can prevent the reaction from setting in. This is no case of wish-fulfilment, and it would certainly be fatal to sit back and wait for the rot to set in. The rot will only become effective after a major defeat, and then only if the defeat is followed by stagnation or still more defeats. A sense of futility is the final conqueror of nations; men will fight for something, whether it is freedom or power, but they will not go on fighting just for its own sake. The goal must be obvious. It is our job to take away the goal, or at least make it obviously unattainable.

But that is by the way. The power produced and likely to be produced by aero engines is a reasonably calculable thing. What is not calculable is the movement of the air past bodies of different shapes travelling at different speeds. Very little is known even about the movement of the air over the ground and its effect on aeroplanes. The gliding people know something about it. Any soaring expert will tell you that a sailplane *sounds* different when it is flying downwind, so there must be some interesting difference between the structure of the air over the ground according to whether one is flying upwind or downwind.

We all remember the fantastic arguments about upwind and downwind turns. Theoretically, an aeroplane, once it has left the ground, is living in its own medium and is entirely unaffected by earthly affairs, but the fact remains that there are differences, and these are only explained by some sort of ground effect which is noticeable up, at least, to heights of the two thousand order. (For the dismemberment of the downwind turn maniacs I must add that at such a height the ground is so far away that nothing matters at all—in other words, the whole thing may be a product of the imagination, and downwind turn accidents are merely the result of bad judgment!)

### Air Vagaries

Nevertheless, the air does do peculiar things. I remember once flying over a stretch of moorland and finding that the airspeed had dropped by ten to fifteen miles an hour. The drop was consistent and never varied during a period of at least five minutes. My explanation was that there was a more or less universal downdraught over the moor, and that the speed was lost in an automatic endeavour to maintain height—I was flying at about a hundred feet, and the desire, at that height, to keep away from the ground is fairly strong. Through the air I was climbing very slightly the whole time, while over the ground a constant height was being maintained. Somebody may be able to explain why such a continuous downdraught should be found over a nice, round, heather-covered hill.

Perhaps the local conditions were similar to those on days when pilots say that there is "no lift in the air." Such conditions usually apply when the weather is hot, when there is no wind, and when there is a curious dampness about the whole world. They do not necessarily apply just because it is hot. The molecules have to be widely spaced! And all of them going down rather than up. Those are the impressions one gains, nonsense though they may appear.

"INDICATOR."

# Service Aviation

## Royal Air Force and Fleet Air Arm News and Announcements

### London Gazette

OWING to the rate of growth of the Royal Air Force and the consequent increase in the lists of appointments and promotions, we have reluctantly decided to discontinue from now onwards publication of the quotations from the *London Gazette*. Publications of awards and the Roll of Honour will, of course, be continued.

### Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

BAR TO THE DISTINGUISHED SERVICE ORDER.

**Sqn. Ldr. J. B. TAIT, D.S.O., D.F.C., No. 35 Squadron.**—In June, 1941, this officer was the captain of the leading aircraft of a formation of three bombers which carried out an attack on Kiel in clear daylight. Despite accurate anti-aircraft fire, bombs were dropped and observed to burst on the objective. The success which attended this operation was largely due to the magnificent leadership and courage, together with the brilliant airmanship, displayed by this officer.

DISTINGUISHED SERVICE ORDER.

**Wing Cdr. G. FRANCIS, D.F.C., No. 230 Squadron.**—During the evacuation from Greece this officer directed the operations of two flying boat squadrons which evacuated some 700 British personnel and a number of Greek and Yugo-Slav personalities. He personally accomplished some noteworthy flights which, combined with his inspiring leadership, contributed largely to the success achieved.

After Crete had been evacuated Wing Cdr. Francis undertook a flight in an endeavour to establish contact with some British forces believed to be holding out in a certain locality there. This necessitated flying at night off unfamiliar coast.

Nevertheless, Wing Cdr. Francis skilfully piloted his aircraft to within five miles of his objective, where he was forced to alight on the water owing to the rough sea. He taxied towards the coast and, while a boat was being launched, the enemy opened fire with machine guns from short range. Wing Cdr. Francis subsequently took off and flew over the coast, making signals and dropping messages. Throughout this hazardous and difficult operation he showed great courage, skill and determination.

**Sqn. Ldr. E. A. WHITELEY, No. 69.**

**Sqn. Ldr. E. G. JONES, D.F.C., No. 80.**

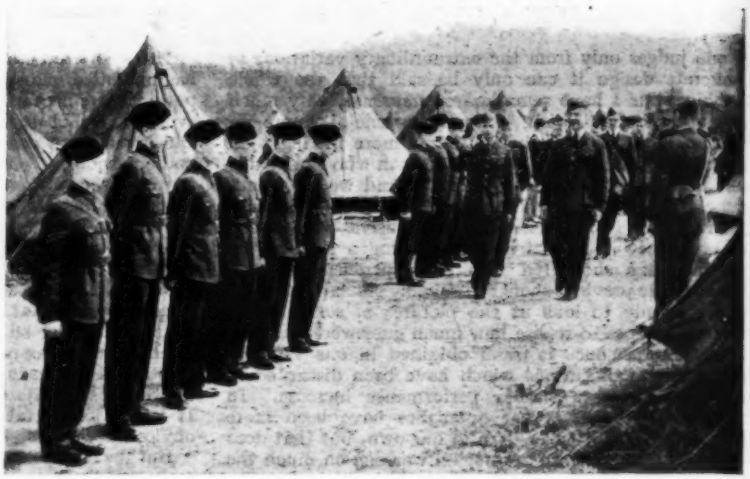
**F/O. D. L. PRICHARD, R.A.F.V.R., No. 75 (N.Z.) Squadron.**—One night in June, 1941, this officer carried out an attack against Cologne. While some distance from his target and when on the edge of a dense belt of searchlights through which he had just flown, F/O. Prichard's aircraft was attacked by an enemy fighter which opened fire from very close range. A cannon shell damaged his engine—almost severing one of the airscrew blades—while the rear gun turret was completely put out of action.

Although forced to fly at reduced speed with subsequent loss of height and all powers of defence gone, F/O. Prichard continued his mission, overcoming almost insuperable difficulties before finally dropping his bombs in the target area.

Despite a harassing return journey, he skilfully flew back to base, where he successfully crash-landed his aircraft without injury to his crew. On a previous occasion, F/O. Prichard displayed great flying skill, which enabled his crew to shoot down an enemy fighter which attacked his aircraft when returning from a successful attack on Brest. Throughout the numerous operational flights in which he has participated, this officer has displayed high courage, skill and devotion to duty.

DISTINGUISHED FLYING CROSS.

**Major J. T. DURRANT, S.A.A.F., No. 40.**
**Act. Sqn. Ldr. D. A. ROBERTSON, No. 217.**
**Act. Sqn. Ldr. P. R. WOODWARD, No. 230.**
**Flt. Lt. D. G. E. BENZIE, A.A.F., No. 612.**
**Flt. Lt. F. C. POWLES.**
**Act. Flt. Lt. B. DEAVES, No. 148.**
**Act. Flt. Lt. D. S. LINDSAY, No. 201.**
**F/O. R. A. ACWORTH, No. 112.**



**PARADE, 'SHUN!: The King recently visited Air Training Corps personnel who were in camp at a R.A.F. training depot and the boys of the A.T.C., seen springing smartly to attention as His Majesty inspected their lines, must have experienced a thrill of pride at the honour of a Royal visit.**

**F/O. H. A. DALRYMPLE-WHITE, R.A.F.V.R., No. 70.**
**Act. F/O. W. D. CASTELLO, R.A.F.V.R., No. 37.**
**P/O. H. R. BAILEY, R.A.F.V.R., No. 95.**
**P/O. J. C. COX, R.A.F.V.R., No. 211.**
**P/O. P. GARRARD, No. 59.**
**P/O. C. H. HALL, R.A.F.V.R., No. 38.**
**P/O. R. I. PERRY, No. 115.**
**P/O. D. A. TAYLOR, No. 84.**
**W/O. A. E. WHEELER, No. 210.**

**Sqn. Ldr. R. H. SPENCER, No. 113 Squadron.**—In June this officer led his squadron in successive low flying attacks against a force of 100 enemy tanks which threatened our lines of communication. His determined leadership when attacking proved of great value to the ultimate success of the operations. Throughout the numerous missions in which he has participated, both in the Western Desert and in Greece, Sqn. Ldr. Spencer has displayed outstanding skill and determination.

**Flt. Lt. S. T. MEARES, No. 611 Squadron.**—This officer has consistently displayed enthusiasm and skill when leading his flight or his squadron. He has carried out twenty-eight operations over enemy territory, during which he has destroyed two Messerschmitt 109Fs and damaged two Messerschmitt 109s.

**Act. Flt. Lt. H. R. ALLEN, No. 66 Squadron.**—This officer has displayed great determination in combat and has destroyed at least six hostile aircraft. On a recent occasion he encountered a formation of three enemy bombers escorted by five fighters. Flt. Lt. Allen immediately attacked these aircraft, in company with another pilot, and succeeded in destroying one of the fighters.

**P/O. W. G. G. D. SMITH, R.A.F.V.R., No. 611 Squadron.**—This officer has participated in many operational flights over enemy territory and has always displayed the utmost keenness to engage the enemy. During recent operations P/O. Smith has destroyed at least three hostile aircraft.

**F/O. R. H. MOORE, No. 11 Squadron.**—In June F/O. Moore and Sgt. Manly were pilot and navigator/bomb aimer respectively of the leading aircraft of a formation of three detailed to attack enemy shipping in the harbour at Beyrout. Owing to dense and low cloud, the attack was carried out at an extremely low altitude in the face of intense and accurate anti-aircraft and machine-gun fire.

Before reaching the objective the leader's aircraft was hit by a shell which caused considerable damage and injured Manly in several places. Despite this handicap, by his skill and devotion to duty, the formation scored a direct hit on a large enemy merchant ship. Although suffering severely, Manly displayed great resolution and successfully navigated the formation back to base where F/O. Moore skilfully landed his damaged aircraft without accident. P/O. Moore has completed 35, and Manly 42, operational missions, in which they both have shown exceptional keenness and devotion to duty.

**Act. F/O. R. F. OWEN, R.A.F.V.R., No. 85 Squadron.**—In June, 1941, F/O. Owen and Sgt. Hogg were the captain and wireless operator/air gunner respectively of an aircraft which participated in a daylight attack on Kiel. After successfully bombing his objective, F/O. Owen's aircraft was attacked by four enemy fighters whilst attempting to regain formation with his leader. The aircraft was repeatedly hit—the starboard engine and the wireless were put out of action and the beam gunner killed.

Sgt. Hogg coolly returning fire was instrumental in keeping the fighters at long range, which enabled his captain to manœuvre his aircraft and reach cloud cover. Sgt. Hogg thereupon skilfully repaired the wireless set, reconnecting 25 leads with spare wire. Although one engine had ceased to function, F/O. Owen flew safely back to base.

Throughout, this officer displayed excellent skill and courage and was ably assisted by the coolness and ability of Sgt. Hogg.

**P/O. E. H. BAGNALD, R.A.F.V.R., No. 10 Squadron.**—One night in June, 1941, this officer was the navigator of an aircraft which carried out an attack on Bremen. Despite heavy anti-aircraft fire and searchlight activity in the target area, P/O. Bagnald, although the cockpit in which he was operating was penetrated by shell splinters, executed his duties as bomb aimer for some 25 minutes in the most difficult circumstances. On the return journey, P/O. Bagnald was wounded in the left arm, and although in great pain, he continued his navigational duties under severe difficulties and ensured the safe return of his aircraft. Throughout the operation this officer showed great courage and devotion to duty.

**F/O. D. O. HOBBS, No. 219 Squadron.**—This officer has shown the utmost keenness for night flying operations and he has destroyed three enemy aircraft. His devotion to duty has been an excellent example to his fellow pilots.

**P/O. J. P. GEOGHEGAN, R.A.F.V.R., No. 77 Squadron.**—One night in June, 1941, this officer was the observer of an aircraft which carried out an attack on Dusseldorf. During the attack the aircraft was hit and a piece of shrapnel which entered the perspex of the front turret struck P/O. Geoghegan on the left arm, leaving a jagged, open wound. Nevertheless, although in great pain and suffering from shock, P/O. Geoghegan insisted on executing his duties as bomb aimer, and, when a tourniquet had been applied, he returned to his post and finally released his bombs over the target. He subsequently navigated the aircraft safely to base. P/O. Geoghegan has previously participated in attacks against Dusseldorf, Brest and Schwerte and has at all times been a keen and courageous navigator.

DISTINGUISHED FLYING MEDAL.

**Sgt. A. W. HUNTER, No. 148.**
**Sgt. (now temp. Flt. Sgt.) R. F. NODEN, No. 37.**
**Sgt. R. T. PIRIE, A.A.F., No. 612.**
**Sgt. J. RHYDER, No. 228.**
**Sgt. J. RICHMOND, No. 211.**
**Sgt. (now temp. Flt. Sgt.) W. J. STEVENS, No. 53.**
**Cpl. J. J. A. SMITH, No. 211.**
**Cpl. A. C. MARTIN, No. 209.**
**Sgt. W. H. A. JACKSON, No. 105.**
**Sgt. J. A. PURVES, No. 105**
**Sgt. W. N. WILLIAMS, R.N.Z.A.F., No. 105.**

Sgts. Jackson, Purves and Williams were the pilot, wireless operator/air gunner and air observer/navigator respectively of an aircraft which partici-

## SERVICE AVIATION

pated in a daylight attack on Bremen on July 4th, 1941. The formation, which flew in to the target at a height of about 50 feet, delivered its attack on the centre of the town whilst flying through a balloon barrage and in the face of extremely heavy fire from the ground. During the action the aircraft received direct hits, and Sgt. Purves was wounded in the thigh and foot, while Sgt. Williams received wounds in the leg and foot. In spite of his injuries Sgt. Williams successfully navigated the aircraft back to this country. In this he was assisted by Sgt. Purves, who, although seriously wounded and suffering from considerable loss of blood, kept to his post. Sgt. Jackson, with exceptional skill, successfully crash-landed his aircraft on reaching base within a few yards of the ambulance and fire tender which were standing by. These three airmen displayed great courage and determination under extremely harassing circumstances.

Flt. Sgt. **A. Gordon**, No. 84 Squadron. (Since reported missing.)

Sgt. G. **Furney**, A.A.F., No. 84 Squadron. (Since reported missing.)

Flt. Sgt. Gordon and Sgt. Furney have flown together as pilot and wireless operator air gunner respectively on numerous operational flights. In October, when carrying out an attack at Tobruk, their aircraft was attacked by enemy fighters. The engine was disabled, but the attackers were beaten off and Gordon sucessfully force landed in the desert. On another occasion Gordon and Furney participated in an attack on Kucove oil wells. Harassed by enemy fighters, Furney fought back fiercely until he received a severe head wound. Despite damage to the aircraft Gordon skilfully flew it some 200 miles back to his base. In March, 1941, Gordon, accompanied by Furney, carried out an attack on the Italian Fleet off Cape Matapan. In spite of intense anti-aircraft fire Gordon descended to 4,000 feet and scored two direct hits on a cruiser causing it to slow down, and compelling other vessels to stand by. By their success in this operation, Gordon and Furney helped to bring the Italian Fleet to action. Both these airmen have displayed great skill and determination in accomplishing their allotted tasks.

A/C.1 W. N. **Addison**, No 85 Squadron.

This airman has displayed excellent skill and has taken part in the destruction of three enemy aircraft at night.

Sgt. W. T. M. **Clark**, A.A.F., No. 219 Squadron.—This airman has displayed exceptional keenness and ability and has assisted in the destruction of four enemy aircraft at night.

Sgt. M. **Evans**, R.N.Z.A.F., No. 40 Squadron.—One night in June, 1941, this airman was captain of an aircraft which carried out an attack on a dock at Rotterdam. Visibility was poor over the target area, but, in spite of heavy anti-aircraft and searchlight activity and the presence of enemy fighters Sgt. Evans flew over the area for an hour to ensure that his objective was accurately located. He finally released his bombs, which were seen to burst on or very close to the dock.

On the return journey his aircraft was attacked by a Messerschmitt 110. By excellent airmanship Sgt. Evans enabled his rear gunner to fire a burst at the attacker which caused it to dive towards the sea out of control where it probably crashed. Sgt. Evans displayed great leadership, skill and determination throughout.

Sgt. D. P. **Hogg**, No. 35 Squadron.

Sgt. G. E. **Mitchell**, No. 7 Squadron.—One night in June, 1941, this airman was the rear gunner of an aircraft which was detailed to attack Hamburg. On the return journey, an attack was made by a Messerschmitt 110. Despite an intense concentration of cannon and machine gun fire from the attacker, Sgt. Mitchell withheld his fire until the enemy came within close range. He then fired a burst of 600 rounds at the aircraft, which broke away with its port engine aglow. It was subsequently confirmed that this aircraft was destroyed. Sgt. Mitchell displayed great courage and determination and set an excellent example.

Sgt. A. W. **Steven**, No. 35 Squadron.—In June, 1941, this airman was the observer of an aircraft which participated in a daylight attack on Kiel, when he displayed exceptional ability and great devotion to duty.

L.A/C. M. **Griffin**, R.A.A.F., No. 10 Squadron.—In June, 1941, this airman was the first fitter of a Sunderland aircraft which, in the course of an operation, was attacked by an enemy Focke-Wulf aircraft. After the engagement it was found that the Sunderland was losing large quantities of oil. L.A/C. Griffin crawled into the wing and discovered two large holes in the bottom of the oil tank.

Returning to the hull he obtained tools, plugs and a two-gallon drum of oil, which he took into the wing and, after plugging the holes and piercing the top of the oil tank, he poured in the oil by means of a small tin, and in this way succeeded in maintaining a continuous supply of oil. L.A/C. Griffin made four journeys into the wing, and in all spent two hours nursing the engine in intense heat and in a very cramped position. He displayed great devotion to duty and materially contributed to the safe return of his aircraft.

Sgt. T. F. **Manly**, No. 11 Squadron.

Sgt. W. McM. **Gilmour**, R.A.F.V.R., No. 611 Squadron.—This airman has displayed excellent qualities as a fighter pilot. During the recent intensive operations over enemy territory Sgt. Gilmour has destroyed three hostile aircraft. He has set an excellent example throughout.

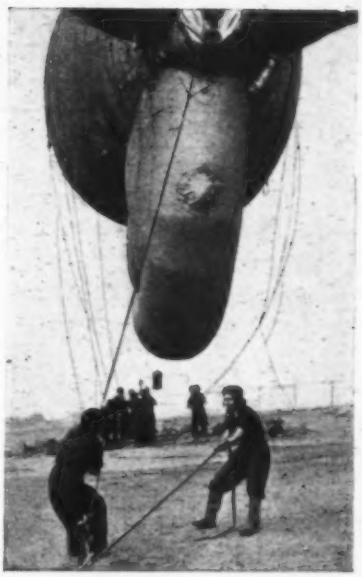
THE KING has been graciously pleased to approve the following award in recognition of gallant conduct:—

### Military Cross.

F/O. A. G. **Cork**.—In April, 1941, this officer was second in command of his squadron's outparty, which embarked at Alexandria for Greece. During the voyage he was in charge of four Lewis gun positions manned by personnel of the squadron. On the outward journey the convoy, and his ship in particular, were attacked three times from the air before reaching Suda Bay, and once again while in the bay. When returning to Alexandria, in convoy, a further four attacks were made.

Throughout all these attacks, which were made either by dive bombing or torpedoes, F/O. Cork controlled and used his guns continuously, manning individual gun positions in turn himself, although in an exposed position on the upper deck. His splendid leadership inspired the gun crew to resist the enemy with vigour and accuracy.

**TWO TOP-NOTCHERS: Britain knows the sterling qualities embodied in the familiar and beloved figure in the foreground of this lucky snap; and the Hun is being made painfully aware of the qualities of the Stirling bomber whose take-off the Prime Minister is watching.**



**THEY'VE GOT A PULL: Women always did have a pull, anyway, but now that the W.A.A.F. is taking over the balloon sites, they are, as this picture shows, putting it to good use.**

THE KING has been graciously pleased to approve the award of the George Medal to:—

P/O. P. T. **Curry**, R.A.F.V.R.; L.A/C. H. R. **Garner**, R.A.F.—This officer and airman displayed courageous conduct when an aircraft, with a full load of bombs, crashed and burst into flames one night in May. They succeeded in extricating two of the crew who were trapped in the aircraft, while the bombs were actually exploding.

THE KING has been graciously pleased to approve the award of the British Empire Medal (Military Division) to the undermentioned:—

Sgt. P. E. **Pacey**, R.A.F.—One day in April this airman was despatcher in an aircraft which crashed on landing and immediately burst into flames. He saw the six passengers, who were in his charge, to safety and, in spite of severe leg injuries, unhesitatingly re-entered the aircraft and crawled up the fuselage to rescue the wireless operator whose clothes were on fire. The fuselage tanks exploded and set fire to Sgt. Pacey's clothing just as he succeeded in dragging the wireless operator clear of the aircraft. Sgt. Pacey took a considerable risk in re-entering the blazing aircraft and set a splendid example of courage and self-sacrifice.

Sgt. D. F. **Allen**, G.M., R.A.F.—One evening in April an enemy aircraft dropped incendiary bombs on an aerodrome. One bomb fell into the cockpit of an aircraft on the ground and lodged beneath the seat and under the front of the fuselage petrol tank in a position which prevented its removal. Sgt. Allen attempted to extinguish the incendiary, but his efforts were unavailing owing to its position. He therefore climbed into the cockpit and, although fully aware that the fuel tank was likely to explode at any moment, he plied fire extinguishers against the side of the tank and put out all but the incendiary until it was finally extinguished. At the time a large number of men were engaged in putting out other incendiaries near the aircraft. There is no doubt that Sgt. Allen, by his initiative and gallant conduct in the face of extremely dangerous conditions, prevented many casualties which would certainly have occurred had the tank exploded.

THE KING has also been graciously pleased to give orders for the publication of the names of the undermentioned airmen in the London Gazette as having received an expression of Commendation for brave conduct in connection with Civil Defence:—

Act. Cpl. Charles Walter **Lyner**.
L.A/C. Daniel John **Wright**.

THE KING has granted unrestricted permission for the wearing of the undermentioned decorations, conferred on the officers and airmen indicated in recognition of valuable services rendered in connection with the war:—

Conferred by the Polish Government.
Polonia Restituta—*First Class.*

Air Chief Marshal Sir Charles F. A. **Portal**, K.C.B., D.S.O., M.C.

*Second Class*

Air Commodore A. R. **Boyle**, C.M.G., O.B.E., M.C., R.A.F.V.R.
Air Commodore Douglas **Colyer**, D.F.C.

**Flt. Lt. James Lacey (D.F.M. and bar, but "Ginger" to his comrades) has been presented with the first parachute to reach Britain from Australia, and also with a silk scarf made by 85 girls in the Sydney factory. "Ginger" Lacey has already baled out nine times and claims a bag of 24 Germans.**

*Third Class.*
Wing Commander E. C. LEWIS.
Wing Commander K. P. LEWIS.

KRZYZ ZASLUGI (CROSS OF MERIT).

Sergeant Geoffrey Charles EVERITT, R.A.F.V.R.
Leading Aircraftman G. N. BIDDLE, R.A.F.V.R.
Leading Aircraftman Walter BROADBENT.
Aircraftman 2nd Class William Thomas ABLEY.

## *Roll of Honour*

*Air Ministry Casualty Communique No. 75.*

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed.

KILLED IN ACTION (WHILE FLYING IN OPERATIONS AGAINST THE ENEMY).—F/O. C. S. Brocklebank; Sgt. W. Brown, D.F.M.; Sgt. M. V. Browne; Sgt. J. H. Grubb; Sgt. B. C. C. Harpur; Sgt. D. A. Maclean, Sgt. A. Malone; Sgt. K. H. Sanders; Sgt. F. A. Thornber; Sgt. S. Veitch; P/O. J. N. Whitmore; F/O. J. D. G. Withers, D.F.C.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. Anderson; Sgt. E. B. Childs; Sgt. J. Crawford; P/O. J. N. Fisher; Sgt. A. M. Goldfeather; Sgt. M. H. E. Hine; F/O. D. Linguood; F/O. R. D. Masters; F/O. S. Paget; Sgt. C. B. Parris; Sgt. E. J. Pritchard; P/O. R. C. Rendle; Sgt. J. A. Selley; P/O. G. G. Sharp; Sgt. G. Sigsworth; Sgt. J. G. Stewart; P/O. W. P. Strickland; Sgt. D. V. Taylor; Sgt. W. Tubberdy.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. C. Ashman; P/O. E. J. Bainbridge; Sgt. A. F. Bean; P/O. J. C. E. Beelaerts van Blokland; Sgt. F. E. Blofield; Sgt. R. Bracchi; Sgt. D. R. Briggs; Sgt. F. A. Buckie; Sgt. L. S. Carvil; Sgt. A. J. P. Casey; P/O. J. Coggins; Sgt. G. E. Cowan; P/O J. C. Dale, Sgt. J. P. Donlon; Sgt. R. J. Farthing; Act. Sqn. Ldr. D. V. W. Francis; F/O. V. T. H. Frith; P/O. V. D. Fry; Sgt. V. C. Gifford; P/O. G. H. Hannan; Sgt. M. J. O. Heaney; F/O. A. P. Hovenier; Sgt. W. D. Ingrams; F/O P. J. Jenkins; Sgt. D. K. Leaver; Sgt. T. O Liggins; Sgt. G. H. Lyle; Sgt. E. M. W. McKim; Sgt. L. E. Magee; Sgt. G. G. Moffat; Sgt. F. G. Moir; Sqn. Ldr. G. W. Montagu; F/O. E. Pennington; Sgt. P. R. Prosser; P/O. E. Reeve; Sgt. H. R. Richardson; Flt. Sgt. P. R. Richardson; Sgt. E. S. Rimes; Sgt. A. L. Sargeant; Act. Flt. Lt. A. T. N. Scoltock; Sgt. J. B. Scotchmere; Sgt. C. J. Smith; Sgt. R. F. Stacey; Sgt. W. R. Starns; Sgt. J. H. Tiedeman; Sgt. J. W. Unett; Sgt. G. M. Willcox; Sgt. A. M. Wood; Sgt. J. C. Woodcock; Sgt. A. A. Wooding.

PREVIOUSLY REPORTED MISSING BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Sgt. W. Russell.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. E. L. Stoodley.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED KILLED IN ACTION.—P/O. S. G. Esson.

WOUNDED OR INJURED IN ACTION.—Wing Cdr. H. P. Burwood; Sgt. J. N. Dennis; Flt. Sgt. J. H. P. Dwyer; Sgt. A. P. J. Grundy; Sgt. J. K. Henson, Sgt. L. G. H. Hingley; Sgt. R. S. Miles; P/O. L. A. J. Mills; Sgt. L. J. Olderbolz; Sgt. K. A. Osborn; Sgt. G. D. P. Quinn, D.F.M.; Sgt. L. J. Richards; L.A/C. R. Ritz; Sgt. J. I. Robinson; F/O. D. Stewart-Clark; Sgt. A. Wood.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. R. J. R. Martin; Sgt. A. U. Simpson; Sgt. F. E. Tingley.

PREVIOUSLY REPORTED WOUNDED OR INJURED IN ACTION NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sqn. Ldr. J. V. C. Badger.

MISSING, BELIEVED KILLED IN ACTION.—P/O N. C. Alers-Hankey; Sgt. D. R. Black; Sgt. J Bradshaw; Sgt. A. G. Burbridge; Sgt. J. Chapman; P/O R. S. Chisholm; Act. Sqn. Ldr G. C. N. Close; Sgt. J. E. Gittins; Sgt. A. Greenside; Flt. Lt. G. F. Gregory; P/O. A. V. J Hardcastle; Sgt. F. A. Hatton; Sgt. J. K. E Horniman; Sgt. G. W. L. Matthews; Sgt. W. H Mounseer; P/O. P. Myers; Sgt. F. W. O'Brien; P/O. R. F. Payne; Sgt. K. M. Poole; Sgt. G. A. Selby; Act. F/O. W. C. Taffender; Sgt. G. L. Tompson; Sgt. E. W. Tyler; Sgt. W. L. Waite; P/O. D. F. Walker; Act. Sqn. Ldr. M. L. Watson; Sgt. E. E. Weldon; Sgt. K. R. Winter.

MISSING.—Cpl. N. B. J. Alexander; A/C.2 V. J Allen; Sgt. W. J. Baird; Cpl. H. L. Barber; Sgt. G. McD. Barclay; P/O. J. Barrett; Sgt. L. Beaumont; P/O. J. F. Bendix; Sgt. J. Bestwick; F/O J. Beveridge; Act. Sqn. Ldr. G. O. L. Bird, D.F.C.; A/C.2 H. Bishop; Sgt. K. C. Bisson; Sgt. J. C. E. Black; P/O. A. Bleakley; P/O. S. Bowes; Sgt. P. J. Breene; Sgt. M. D. Brooker; Sgt. P. Brown; L.A/C. J. W. Browne; Sgt. I. A. Bullivant; P/O. G. F. Burbridge; Sgt. F. A. Burrows; Flt. Lt. N. K. Burton-Chadwick; P/O. F. A. Caunter-Jackson; Sgt. C. T. Chipperfield; Sgt. W. Connell; Sgt. N. L. Conrade; P/O. S. Cook; Sqn. Ldr H. D. H. Cooper, D.F.C.; A/C.1 D. Copley; Sgt. G. A. D. Cotton; Sgt. C. C. Cox; Sgt. R. L. Cox; Sgt. D. B. Crabtree; Sgt. A. D. Cragg; A/C.1 G. G. Craggs; L.A/C. A. Crawford; Sgt. J. L. G Creed; L.A/C. J. C. Croome; L.A/C. F. E. Crundwell; Sqn. Ldr. E. Culverwell; L.A/C. J. Cunliffe; Sgt. E. Curle; Sgt. J. W. Davidson; Sgt. R. D. Davidson; Sgt. D. V. Davis; A/C.1 A. H. Diamond; P/O. D. G. Dickie; Sgt. J. A. Donald; Sgt. A. P. Drane; A/C.2 J. Dunlop; P/O. H. P. Duval; A/C.2 D. J. Fellowes; A/C.2 A. Fenger; P/O. J. D. Forrest; P/O. W. M. W. Fowler; Sgt. S. D. Gallery; L.A/C. W. H. Gill; Sgt. A. L. Glaves; Sgt. H. Godfrey; P/O. G. E. Goodman, D.F.C.; L.A/C. E. T. Goodsell; P/O. A. L. Gordon; Flt. Lt. P. O. V. Green; Flt. Sgt. T. R Green; Sgt. H. Gretton; P/O C. E. Greville-Heygate, D.F.C.; Sgt. V. J. Griffiths; Sgt. E. R. Hall; Sgt. J. H. Harris; P/O. P. A. Harris; Sgt. D. H. Harrison; P/O. W. G. Henderson; Sgt. W. P. Herman; Sgt. V. E. Hill; Sgt. R. F. Hind; A/C.1 R. S. Hodgson; P/O. J. E. Horsfield; Sgt. G. Houghton; P/O. P. R. G. Howes; A/C.1 T. O. Huggins; Sgt. W. D. Hughes; Sgt. G. T. Hunt; Sgt. H. Hutchinson; A/C.2 J. Hynd; P/O. D Irving; Sgt. G. T. Jones; Sgt. J. A. H. Jenks; P/O. M. N. F. Jones; Sgt. H. H. Joslin; Sgt. F. T. Kearney; Flt. Lt. D. D. A. Kelly; F/O. R. T. W. Ketton-Cremer; Sgt. B. Kirkham; P/O K. E. Knox; L.A/C. G. F. Langford; F/O. R. R. Langley, D.F.C.; P/O. S. J. Leach; Sgt. F. H. Leveridge; Sgt. V. A. Lewis; A/C.1 J. W. F. Liddle; Sgt. H. Lilley; P/O. J. S. Logan; A/C.2 A. Lonsdale; Cpl. L. Lyne; L.A/C. I. MacD. MacQuarrie; A/C.2 P. Mace; Act. F/O. D. Mackay; Sgt. F. P. Mackrill; L.A/C. E. W. Mansell; Flt. Sgt. S. F. Marais; Sgt. V. H. Marks; Sgt. A. E. Middleton; Sgt. T. H. Mitchell; F/O. W. N. Monteith; P/O. L. J. Moore; Sqn. Ldr. J. C. Mungo-Park, D.F.C.; Sgt. C. H. Naylor; Flt. Lt. M. A. Newling, D.F.C.; Sgt. C. G. E Newton; Sgt. A. P. Nicoll; Sgt. P. B. Nicolson; P/O. R. E. H. Nowell; F/O. A. K. Ogilvie, D.F.C.; Sgt. J. A. Oxley; A/C.1 F. Patterson; P/O. J. F. Philpott; Sgt. R. A. Pickers; Flt. Sgt. A. Pratt; P/O. P. H. H. Pritchard; F/O. H. A. R. Prowse; Cpl. H. R. Pye; P/O. R. W. B. Rainford; Sgt. E. J. Rapley; L.A/C. G. W. Reed; Sgt. W. J. P. Rice; L.A/C. A. R. Richardson; Sgt. J. C. Robertson; Flt. Sgt. J. S. Robertson, D.F.M.; P/O. A. W. Robson; Act. Sqn. Ldr. B. J. Rogers, A.F.C.; Flt. Lt. B. A. Rogers; Sgt. D. C. Ross; A/C.2 G. H Said; Sgt. L. F. S. Salt; P/O. R. G. Sammons; A/C.2 A. H. Schofield; Sgt. I. D. Scourfield; Sgt. E. Shackleton; P/O. A. F. Sharp; A/C.1 L. T. Simmons; Flt. Sgt. J. H. Simpson; A/C.1 T. G. Skipworth; Sgt. W. A. Smallbone; Sgt. D. H. Smith; Sgt. J. F. Smith; Sgt. L. Smith; L.A/C. R. Snowdon; Sgt. M. S. Soames; Sgt. P. Somers; Sgt. L. E. Stalder; L.A/C. J. J. Stephenson; P/O. I. M. Strachan; Sgt. D. D. Strickland; F/O. J. G. R. Sturrock; P/O. A. Sumner; Sgt. R. J Thorburn; A/C.1 A. Thorpe; Sgt. H. Trenholm; P/O. G. Troup; L.A/C. J. T. Walker; Sgt. P. J Walker; A/C.2 E. J. D. Walton; Sgt. R. C. Watkins; Flt. Lt. A. W. K. Watson; Sgt. C. R. Wells; L.A/C. J. O. Weston; L.A/C. C. G. White; Sgt. E. G. Whitehead; Sgt. L. R. Wilson; Sgt. N. S. Wilson; Act. Flt. Lt. P. Windram; L.A/C. E. A. Winterflood; L.A/C. M. G. Wood; A/C.2 J. Woodhead; A/C.1 D. J. Woods; F/O. E. J. Woods; Sgt. J. G. Woolley; P/O. F. B. Yard.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW REPORTED MISSING.—Sgt. P. A. M. Burrell; Sgt. G. W. Clawley; Sgt. E. J. M. Whittle.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE (WHILE ENGAGED ON NON-OPERATIONAL FLYING DUTIES OR ON THE GROUND THROUGH ENEMY ACTION).—L.A/C. H. Blundred; Sgt. F. D. Drake; L.A/C. H. F. Leese; L.A/C. L. C. Nash; L.A/C. G. A. Stone.

KILLED ON ACTIVE SERVICE.—A/C.2 W. E. Armstrong; Cpl. M. E. Balkin; L.A/C. H. Barton; Sgt. J. R. Bolton; L.A/C. C. H. Booth; Sgt. A. W. E. Boulden; Flt. Lt. F. G. O. Box; P/O. K. D. Brant, D.F.C.; Cpl. H. E. Burton; Sgt L. B. Butler; Sgt. A. Campbell; Sgt. H. P. Clapperton; P/O. C. G. Colbrone; Sgt. H. A. Colborne; Act. F/O. W. H. Corbett; A/C.2 L. G. Cripps; L.A/C. P. G. Davies; Flt. Lt. S. A. Ellaby; Cpl. R. A. Fish; Sgt. J. E. Foster; Sgt. D. A. Frost; Sgt. J. Goldman; Sgt. A. M. Greenaway; P/O. A. T. E. Greenway; Sgt. W. G. N. Hare; Sgt. L. R. Hinde; Act. P/O. J. M. Johnston; Sgt. P. Lally; P/O. M. F. S. Laughton; Flt. Sgt. F. H. D. McCuan; Sgt. K. T. W. Mitchell; W/O. R. L. W. Mitchell; P/O. M. R. P. Oxley; P/O. R. W. Parish; P/O. D. R. Parker; Sgt. H. W. Parry; Sgt. A. Pepper; Sgt. H. G. A Reed; P/O. R. Rimmer; Sgt. T. H. W. Seaward; Sgt. C. R. Sanders; P/O. J. F. Saward; A/C.2 A. Smith; L.A/C. H. W. Spratt; Sgt D. J. Taylor; Sgt. H. J. Taylor; A/C.2 J. Trafford; Sgt. L. B. Tunstall; Act. Flt. Lt. D. P. Tuppen; Sgt. R. Turner; Sgt. H. Ursell; Sgt. K. F. Wilson; Cpl. W. S. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—A/C.1 A. W. Davies; Sgt. J S. Dickson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sqn. Ldr. R. J. Bennett; Sgt. H. B. McGregor.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—P/O. W. E. Drew; Sgt. J. Emery; Sgt. T. B. Kenny; Sgt. C. McP. Mitchell; F/O J. H. Steyn, D.F.C.; Sgt. H. A. Tompsett.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. K. S. Browning; Sgt. A. D. Buchanan; Sgt. H. A. Church; Sgt. J. F. Cooper; L.A/C. W. H. Ford; L.A/C. A. Hampshire; Cpl. J. A. Hood; L.A/C. F. J. Jackson; Sqn. Ldr. C. J. F. Kydd, D.S.O., D.F.C.; L.A/C. A. K Newnes de Souza; L.A/C. M. H. Oddie; A/C.1 D. A. Robertson; Sgt. J. J. Thompson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 J. Carwyn; Cpl. H. Hesketh; A/C.2 G. L. Howard; Sgt. J. C. Kenyon; Cpl. L. King; P/O. E. H. Orton; L.A/C. F. C. Puddifoot; A/C.2 G. A. Sanders; P/O. N. Taylor; Cpl. R. Whitehead.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—A/C.1 J. C. Matthews.

DIED ON ACTIVE SERVICE.—L.A/C. C. Allan; Sgt. E. Annesley-Cooke; A/C.2 E. J. W. Bacon; A/C.1 W. F. Beardmore; A/C.2 G. W. Bell; Sgt. L. G. J. Bingley; A/C.2 S. P. Binks; Flt. Sgt. E. C. W. Broad; A/C.1 T. H. Brown; A/C.2 R. W. Buckland; A/C.1 A. R. Bull; Cpl. J. D. Dodd; Act. Sqn. Ldr. H. W. Dreyer; A/C.2 J. Evans; P/O. H. G. Gilliland; A/C.1 W. H. Goodwin; Cpl. F. L. Hambleton; Sgt. J. J. Joicey; L.A/C. W. Lintin; L.A/C. R. J. McLintock; A/C.2 E. Mercer; A/C.1 A. Milner; Cpl. R. Mitchell; Cpl. C. A. Musgrove; F/O. R. Parker; L.A/C. A. E. Phelps; Sgt. E. F. Powell; L.A/C. L. G. Proud; L.A/C. R. J. Ratliff; A/C.2 D. Smith; A/C.1 J. Smith; A/C.1 E. Stack; A/C.2 C. L. Stevens; F/O. H. N. Thomas; Cpl. W. H. Titterton; Sgt. S. C. Tompsett; A/C.2 E. W. Townend; Cpl. C. Waddington; A/C.2 D. E. Williams; L.A/C. W. P. Wise; A/C.2 H. Woods; Act. P/O. G. F. Woolhouse.

PREVIOUSLY REPORTED MISSING, NOW REPORTED SAFE.—Sgt. R. Morgan.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. E. J. Smith.

AMENDMENT TO PRESS COMMUNIQUE No. 73.—F/O. C. McK. Scrutton should read Flt. Lt. C. McK. Scrutton.

## *Indian Air Force*

KILLED ON ACTIVE SERVICE.—P/O. Chaudhuri Kali Prasad; P/O. Khan Pasha Ali Raza; P/O. Singh Gurbachan.

## *Royal Canadian Air Force*

MISSING.—Sgt. K. J. Barton; Sgt. H. B. Bedard; P/O. L. H. Campbell-Rogers; Sgt. J. D. MacVicar.

KILLED ON ACTIVE SERVICE.—Sgt. R. P. Burt; P/O. D. Cameron; Sgt. C. W. Davis; P/O. G. R. Douglas; Sgt. I. P. Einarson; Sgt. W. E. Yerbury.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. K. Macleod.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. H. J. Kellough.

## *Royal New Zealand Air Force*

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. J. A. Graham.

MISSING.—Sgt. D. A. Dacre; Sgt. M. J. Fraser; Sgt. B. D. J. Kennedy; P/O. A. H. Wise.

KILLED ON ACTIVE SERVICE.—F/O. F. W. Hall-Jones.

## *South African Air Force*

KILLED IN ACTION.—Lt. R. V. Christie.

WOUNDED OR INJURED IN ACTION.—Lt. J. J. Conradie; Major L. C. Theron.

MISSING.—Lt. A. U. M. Campbell; Capt. K. W Driver; 2/Lt. Mitchell; Lt. G. K. Smith Sgt. Van Der Vyver; Lt. J. White

# SERVICE AVIATION